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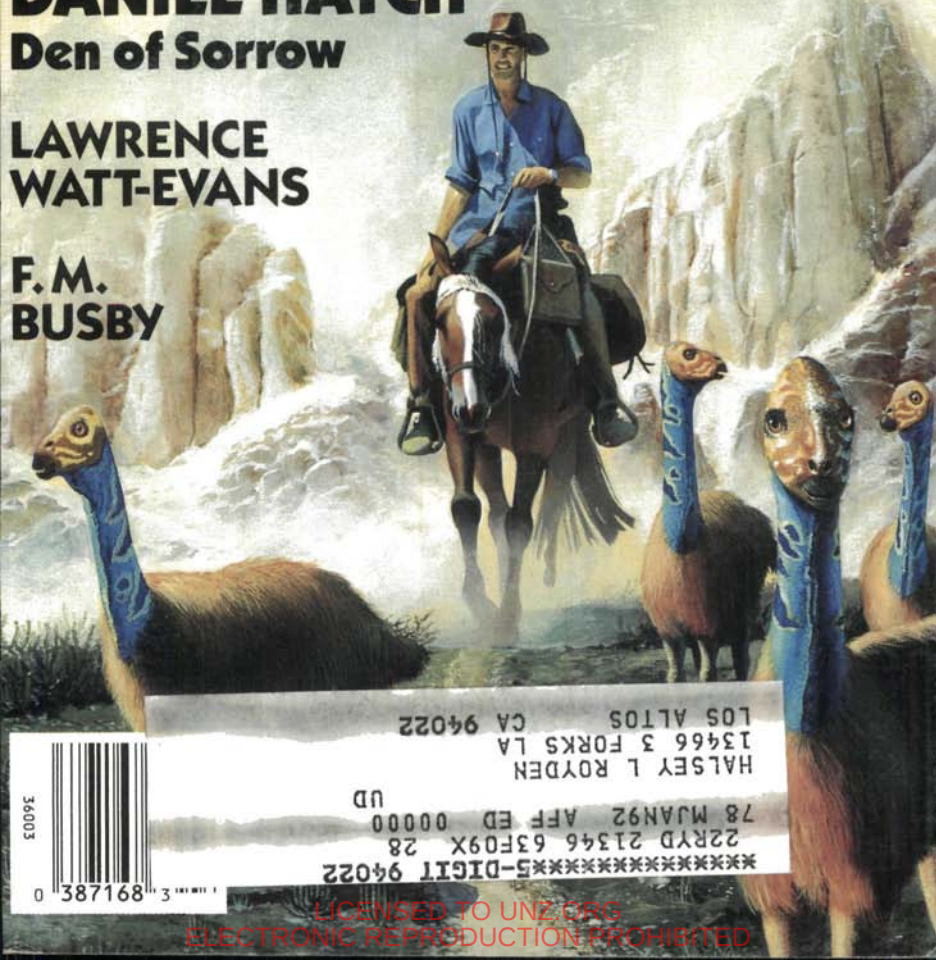

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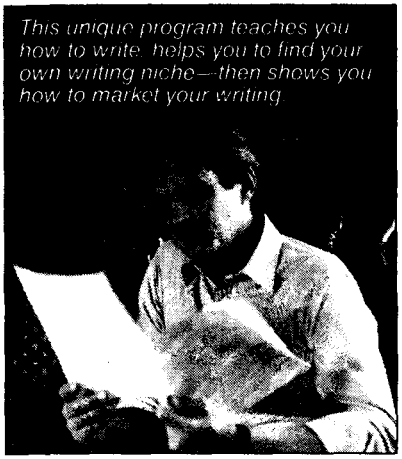
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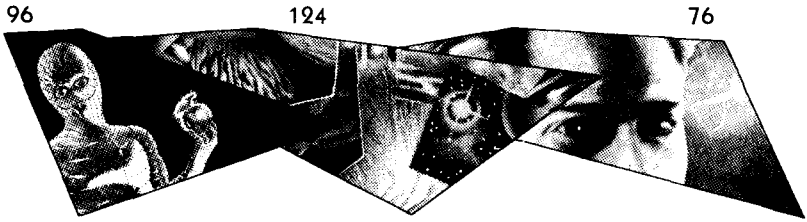

Vol. CXI No. 4
March 1991

Next issue on sale
March 5, 1991

Novelettes

DEN OF SORROW, Daniel Hatch ____ 12
CREATIVE CONSTRUCTIONS, INC., Kent Patterson ____ 76
TIME OUT OF MIND, Bob Howe ____ 124
SCIENCE FICTION, Lawrence Watt-Evans ____ 158

Science Fact

WHAT GOES AROUND, COMES AROUND: WHAT TO DO ABOUT SPACE DEBRIS?, Dr. Gay E. Canough & Dr. Lawrence P. Lehman ____ 54

Short Stories

THE DAY THE SIGNALS STARTED, Francis Cartier ____ 68
EDEN REGAINED, F. M. Busby ____ 96
AN END TO DARKNESS, J. H. Ulowetz ____ 108
SUMMER HOPES—WINTER DREAMS, Mike Moscoe ____ 149

Reader's Departments

THE EDITOR'S PAGE ____ 4
THE ALTERNATE VIEW, G. Harry Stine ____ 104
IN TIMES TO COME ____ 147
THE REFERENCE LIBRARY, Tom Easton ____ 179
BRASS TACKS ____ 187
THE ANALOG CALENDAR OF UPCOMING EVENTS ____ 192

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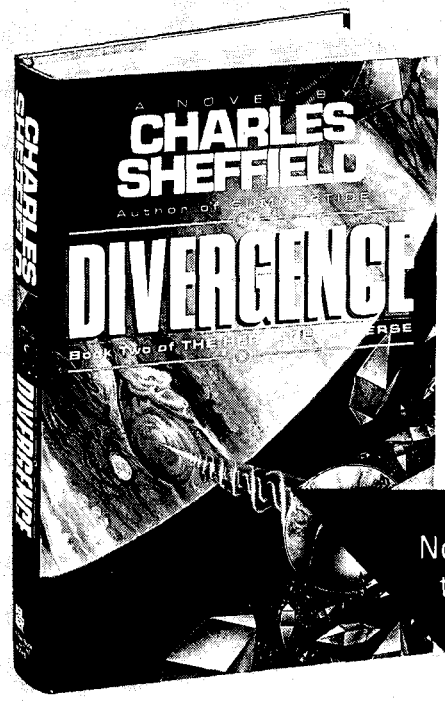
An sf *Heritage* grows ...

with the superb sequel to *Summertide*!



The New York Times called *Summertide* a "well-made puzzle story in the manner of Arthur C. Clarke." *The Washington Post* raved, "if anyone can do a better job of this sort, I'd like to know about him."

Now Sheffield returns to the world called Quake, soon after the planetary upheaval that was Summertide.

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Editorial

PRIMITIVE MACHINES

Stanley Schmidt

You know the stereotypes. Perhaps they were best exemplified by the "Robot Theater" segments on television's old *Laugh-In* show, in which actors and actresses moved stiffly and jerkily about the stage, reciting romantic dialogue in a flat monotone and not quite managing to connect for the final clinch. But you've seen plenty of others. You've lost count of the cartoons, movies, or television shows in which computers or robots had to be addressed via keyboard in an esoteric, highly specialized language, and fouled things up by taking everything very, very literally. In some cases they spoke, but usually in that flat monotone; and if they responded to human speech, it was still with that extremely simple-minded literalness.

Written science fiction, of course, has fairly often been a little more imaginative; but the images in the preceding paragraph pretty well sum up the popular picture of human interaction with "smart" machines. The gist of it is: they may be smart for machines, but they sure are inferior to us humans, yup, yup! That attitude has found its way into our very language in a variety of ways. For example, where I spoke of a "flat monotone," many people would automatically say a "machinelike monotone."

Certainly there is a germ of truth in these images. By now practically all of us have actually heard flat-sounding synthesized voices. We have used, or at least attempted to use, computers with which we could only communicate by

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esoteric commands punched on cards or typed on a keyboard and bearing no discernible relation to our own speech. We have been frustrated by computers which completely misconstrued our intents because of a "trivial" misplaced comma, or insisted on interpreting commands in a bizarre way that was not at all what we thought we were saying. Many of us have been heard to mutter, "Stupid machine!" or words to that effect. It is not without reason that some computers bear signs hand-lettered by their operators, warning, "I will do what you say!"

But there is a subtle, profound fallacy in the popular view. It puts the emphasis on the wrong word. When we find ourselves thwarted by a "stupid machine," many of us tend to blame the problem on the fact that our adversary is a *machine*. But that's not the problem, really. The problem is that it's *stupid*. The fallacy is the assumption that stupidity and machinehood automatically go together. The fact is that stupidity and *primitiveness*—a low level of development—go together.

We have so far dealt only with relatively primitive machines—because we haven't been doing this for very long. We tend to forget that they're primitive, because they're the most advanced machines humans have ever seen. But they are, and we wrongly blame their shortcomings on the fact that they are machines rather than the fact that they are primitive. It would be a good habit to kick, since machines are now evolving quite rapidly. People who insist on feeling smugly and categorically superior to them are in for some *big* surprises!

Consider that matter of voices and the stiff, uncoordinated motions of the "Robot Theater" characters. They're funny, and they do bear a recognizable resemblance to at least some of the robots we've seen so far. The first synthesized voices *were* flat, monotonous, and devoid of inflection; and the first mechanical manipulators were stiff, jerky, and awkward compared to a human surgeon or ballerina. It would be astonishing if they weren't. The actions being mimicked are vastly more complicated than the humans who do them "automatically" realize, and the first attempts to duplicate them cannot be expected to get more than the basics. *But that's not the end of the line!*

If somebody actually wanted to build robots that resembled humans in appearance and behavior, enough to spend the time and money it would take, some of the early models might indeed resemble the caricatures on "Robot Theater." But if interest and funding held out—as they very well might, given the encouragement of even that much success—later models could be far more sophisticated. The television caricatures, whether their creators realize it or not, are not mocking the artificiality of robots *per se*, but rather the simplicity of *primitive* robots. And that can change.

In the case of voices, at least, it has already changed a great deal. In his February 1969 *Analog* editorial, John W. Campbell, fired by enthusiasm from a recent visit to the Bell Telephone Laboratories (a visit to Bell Labs will do that to you!), commented as follows on attempts to enable a computer to speak with a human voice:

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"I heard a computer counting 'One . . . two . . .' not by playing back bits of recorded tape, but by generating the sound-forms of human speech. They were not monotonous, utterly impersonal tones, either; like a human being, the words could have a declarative tone, an inquisitive, or neutral tone. It could, in effect, say, 'Two?' or 'Two!' or simply 'Two.'

"True, as yet it can't count even to ten; as yet, while it can sound like a man's voice, it can't shift to the female mode, or to a small-child tone. But it's pretty clear that science-fictioneers have been wrong in suggesting that a computer's voice will be impersonal. By no means! They've already got a means of making it quite 'personal-human' in timbre."

That was big news, twenty years ago. These days, you probably hear synthesized voices so often you no longer think of them as remarkable, and in many cases you don't even realize that what you're hearing *is* synthesized. I have

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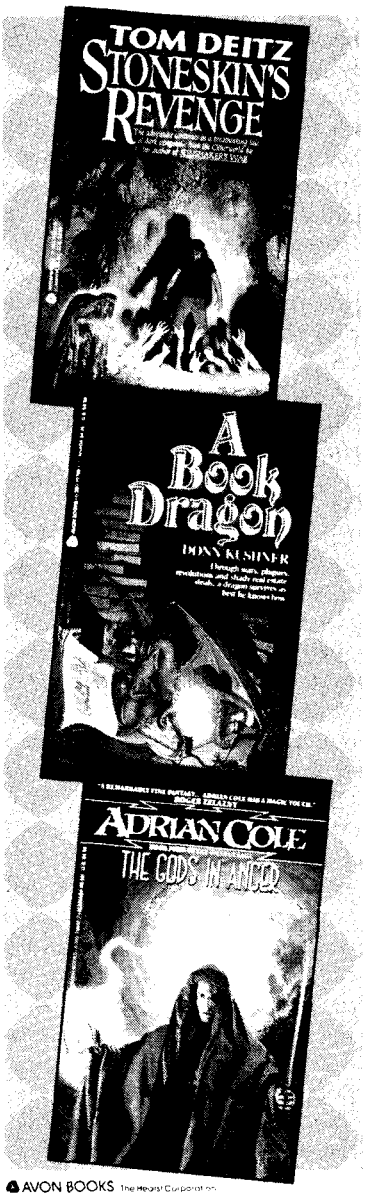

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heard one singing the Queen of the Night's aria from Mozart's *Die Zauberflöte** so realistically that a listener who missed the introduction had not the slightest suspicion that she was hearing anything but a very good, completely human coloratura soprano.

I have also recently visited Bell Labs myself, and met a robot named Sam who not only speaks in a realistic voice with normal inflections, but carries on real-time conversations in complete sentences, acts on instructions given in ordinary speech, and asks for clarification if he doesn't understand them. The very definition of "artificial intelligence" has evolved. The Bell researchers in robotics (or, as they prefer, "interactive systems") no longer consider it sufficient that a machine be able to manipulate lots of data. Now an "artificial intelligence" must be able to make sound decisions and take appropriate actions on the basis of incomplete and flawed data about a world which is constantly changing.

As we do. Sam still doesn't do it anywhere near as well as we do, or in as wide a range of contexts. But he's young. Give him time to grow up. . . .

Many people, of course, don't *want* Sam to grow up. They're scared to death of the idea that machines could *ever* be anything but primitive. Please note: I'm not talking about the people who actually know something about computers and related fields and have serious, thoughtful disagreements about the extent to which machines "can think," and exactly what such terminology means. I'm talking about the multitudes who, with little or no such knowledge, have a powerful, purely emotional reaction that says, "Obviously machines can't think, and never will!" I have asked a number of such people why they believed that, and found little more than a powerful need to feel clearly and forever superior to anything artificial. I think what I was seeing was fear. People who have never had to deal with a man-made being that could interact with them on more or less equal terms simply cannot face the potential dangers implicit in the possibility—so they simply deny that it exists.

There is room for legitimate debate about the extent to which "artificial intelligence" is a meaningful term, and the actual limitations of machine capabilities. You can read such debates in the works of such researchers as Marvin Minsky, Hans Moravec, and Roger Penrose. But regardless of whether we can achieve something you're willing to call true artificial intelligence, the evidence I've seen strongly suggests that we can and will have—and sooner than you think!—things which are awfully hard to tell from it. They may or may not come in packages resembling us; but a great many lines of research are converging on machines which can manipulate, converse, make decisions, and learn from experience at a level of sophistication far beyond what many people are psychologically prepared for.

Does this mean that they won't be allowed to happen, or that humans will be unable to adapt to them? Neither of those seems very likely. The evolution

*A singular appropriate choice of repertoire for such a demonstration, if you think about it. A "magic flute," indeed!

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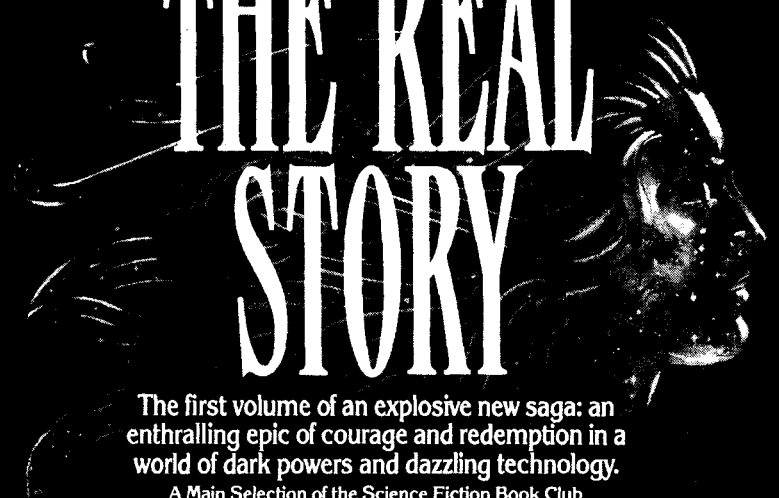

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of knowledge has such momentum that I don't realistically see fear dealing it more than a temporary setback. And I think the fear itself will evolve into a more useful sort of caution, in the usual way.

I remember when computers first began to be used as "teaching machines," and critics frantically warned of the "dehumanizing" effects of letting machines supplant human teachers. Many older adults are still afraid of computers, shying away from using them themselves, and more than a little distrustful of letting them get their electronic clutches on children's minds. But a generation of children is quietly growing up considering computers as normal and comfortable a part of the landscape as rocking chairs, getting complementary parts of their education from human teachers and from computers. From among those children, I think, will come the people best able to deal realistically with both the helpful and the dangerous potentials of highly sophisticated machinery.

Which doesn't just mean computers, of course. There has always, I suspect, been a tendency for people to judge the potentials of any technology in terms of its present capabilities, forgetting that today's "latest thing" is always tomorrow's "primitive and quaint," and fearing to look beyond today's horizon. It would have been a mistake to assume that people could never fly to the Moon because the Wright brothers' first flight could only stay aloft for 12 seconds. It would have been a mistake to assume that attempts to record music were a waste of time because the first efforts sounded terribly tinny, or that I could never have a multi-megabyte computer on my typing table because vacuum tubes were too bulky and hot.

Yet we still make comparable mistakes all the time, attributing shortcomings of primitive machines to the fact that they are machines rather than the fact that they are primitive. We persist in believing that robots will *always* be clunky and simple-minded because that's the only kind we can build *now*, and that electronic music will never sound like "real" music. Some even think they would like to get rid of as much technology of *any* kind as possible because it's energy-expensive and polluting. It doesn't occur to them that energy waste and pollution might be characteristics of primitive industry rather than industry *per se*. If their memories were just a little longer, they might remember what things were like in this country just a few decades ago, when soft coal was widely burned. (For a contemporary Bad Example, see eastern Europe.) The fact is that we have only recently begun to put much effort into making industry truly efficient and clean—and it would be a mistake of the classic kind to underestimate what can be done if that effort is supported and sustained.

Realistically, I suspect, even our descendants will continue to show some of the same sort of shortsightedness. But with change coming as fast as it now is, I hold out just a glimmer of hope that we finally may produce a generation, in the not too distant future, which actually *realizes* that change is a normal part of life—and that it doesn't always stop at the present. ■

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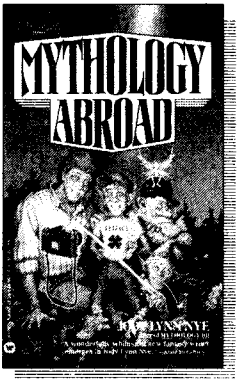

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A WORD FROM BRIAN THOMSEN

When I was in college I never got the chance to study abroad. In fact, the farthest I traveled from my Brooklyn campus was Syracuse, New York and that was for only a weekend. In a way MYTHOLOGY ABROAD is a perfect vicarious semester-long trip to Ireland, filled with humor, magic, and at least a little bit of education. Even though I graduated years ago, I'm still a student, and working as an editor at Questar has definitely been an education...and when you see me around don't forget to ask for next month's homework assignment.

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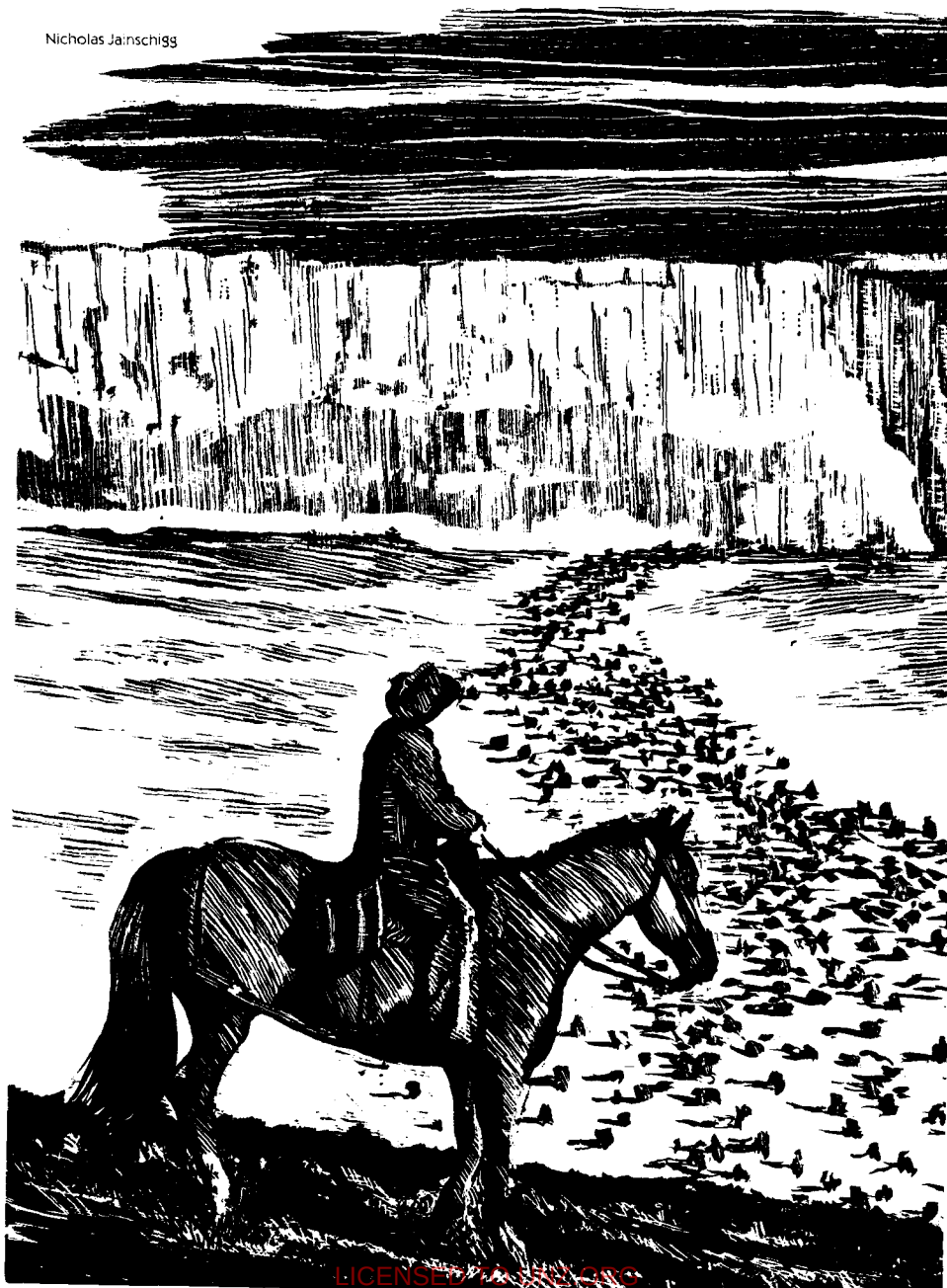

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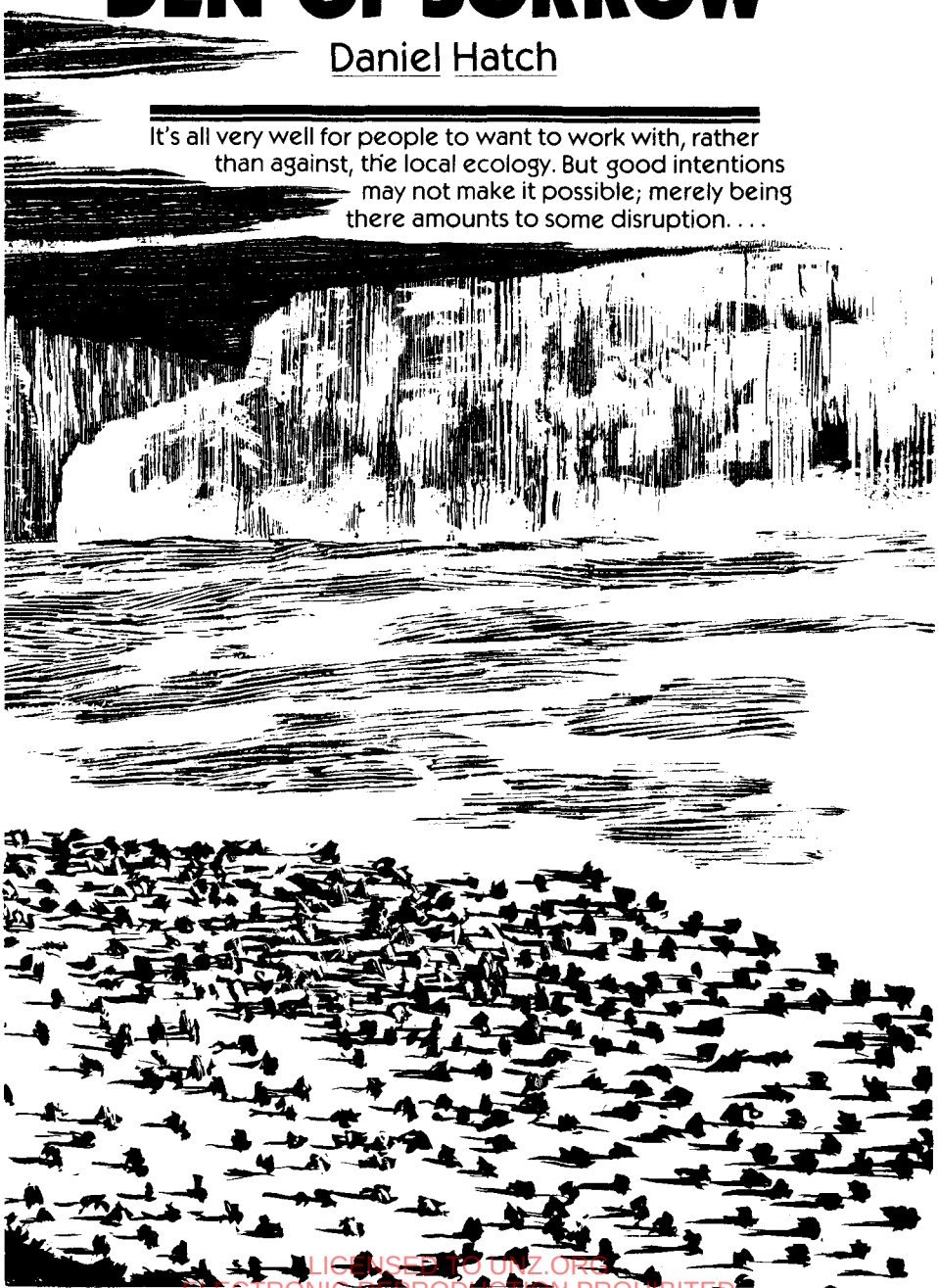
DEN OF SORROW

Daniel Hatch

It's all very well for people to want to work with, rather than against, the local ecology. But good intentions may not make it possible; merely being there amounts to some disruption. . . .



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ONE

Guy Stanger looked into the small cage and searched for a tiny ball of gray fur. He knew the byte was there someplace, hiding under a leaf of the large greenwood branch in the corner or buried in the woodchips at the bottom. He found it after a moment, nestled in a crook of the tree limb.

"What's his name?"

"Mega, and he's a she," said Emily Baxter. "The next cage belongs to Kilo and over there is Giga."

"Don't disturb him," said Suzanne Baxter, Emily's mother, from her desk on the far side of the lab. "He has a lot to do this afternoon. We've got a dozen mazes to run him through."

"That's an awful lot of work for such a little fellow," Guy said. "Are you sure that's fair?"

"I don't think we're asking an awful lot," Suzanne said. "After all, he does represent the pinnacle of the evolutionary process on Asgard."

"Poor little mammaloid. Too bad you haven't evolved any cousins to share the planet with," Guy crooned.

"What about the bits?" Emily asked.

"I think the bytes descended from them, not the other way around," Guy said.

"That's what we're trying to establish," Suzanne said.

Guy looked across the room at the chartpads on the walls. He walked over to one and touched the corner to bring up the menu. He called for the chart marked "Evolutionary Tree." A broad, branching diagram appeared, illustrated with pictures of a variety of fish, amphibians, reptiloids, and fuzzasaurs, with the diminutive byte and bit at the top, sharing equal billing for now.

The wildlife biology lab of Asgard University occupied a large room in a corner of one of the old scout barns in what had once been the Glacier Valley Post. Den Middlesex, the academic den in the Asgard breakthrough colony, had taken over the post when the colony landed nearly a year earlier. Since then, Suzanne had managed to fill it to overflowing with specimens, samples equipment, and supplies.

"And what about the fuzzies?"

"What about them?"

"How do they shake out on the evolutionary scale?"

"They're pretty advanced," Suzanne said. "They have the skeletal architecture of reptiloids, but they changed a lot when the ice age came. They grew fur. A lot of the species adopted mammalian-style herd traits—like the grazers. Some of their behaviors mimic avian lifestyles—migratory patterns and inbred navigational tracks. We're still trying to decide which of the fuzzy species are the most advanced—the predators like the maxidons and the rippers, or the opportunistic carnivores like the grabbers and draggers."

Suzanne ran her fingers through her hair and sighed. "I just hope we have time to complete our studies."

"Time?" Guy asked. "Why shouldn't you have time? You're not going anywhere."

"No . . . but the grazers are. And who knows what else."

"What are you talking about?" he asked, his interest piqued.

"Emily, haven't you told your young

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scout the truth about us colonists yet? It's been three months since he came of age."

Guy felt his face grow red with embarrassment at the unstated meanings flying over his head. Emily took his hand and gave him a puzzled look, then turned the expression on her mother.

"Mother, what in the world are you talking about?"

"I'm talking about the grazer migration, young lady," she said, turning her seat around so that her back was to the laptop. "In a few days, it will be the first day of spring. Shortly after that, the first crowds of bluenecks, redcrests, and silverbacks will begin to infiltrate their way into South Valley, just like they've been doing for thousands of years. Only this year, they're going to be in for a surprise—us.

"Tell me, Guy, you've lived on Asgard all your life. What's going to happen when a quarter of a million grazers try to mix in with thirty thousand farmers just starting to break sod?"

Guy felt a chill run up his back. He had never given that question much thought, but in the past six months, so much had happened to change his world that it seemed like a new problem appeared every week. It didn't take much effort to imagine the ultimate clash that was about to take place between the fuzzies, with their appetite for the savannah grass that covered the floor of South Valley, and the colonists, who were just beginning to establish the colony's agricultural base in the valley's fertile soil. Not only was the grass likely to disappear in short order, but the fuzzasaurs that depended on it were also likely to develop a taste for corn, wheat, quinoa, and anything else that grew in the ground.

"I don't think either one of them are going to be too happy."

"That's an understatement."

"What can we do about it?"

"What have you scouts done about it? You've been here for fifty-five years—excuse me, ninety-three years," she added, correcting to Asgard's calendar.

"We built fences, of course."

"Oh yeah, that's right. I should have thought of that."

"Well, sure, there's only a few thousand of us. But can't the colonists do the same thing?"

"Guy, you know as well as I do that there are agricultural dens in more than two-thirds of the townships in South Valley. How many fences will we have to build to keep the grazers from getting into everyone's fields?"

"I don't know. Ask Joey, he's good with figures," he said, referring to Emily's precocious younger brother.

"No, Guy. I don't need to ask Joey. We haven't even finished building houses for all the colonists. We're not going to shift gears and start turning out fences instead. I'm afraid we're going to have a serious problem on our hands and I don't think there's a lot we can do about it. That means the ag dens are going to have to work it out on their own—each with its own methods. And what scares me is that the some of them are already talking about slaughtering the poor things."

"They wouldn't do that, would they?"

"Have you ever heard of the buffalo, Guy?" Suzanne asked.

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"Isn't that a city on Earth that gets a lot of snow?"

"It was a herd animal back on old Earth. Also known as the bison. They used to cover the plains as far as the eye could see. The Amerinds used to live off them. But when the Europeans came to North America, they began to use industrial methods of mass destruction to harvest them. When they were done, the only buffalo left lived in zoos. I have a terrible feeling that the same thing is going to happen here on Asgard."

"But that's awful. Haven't you been able to figure out a better way to deal with the problem than that?"

"Like what?"

"I don't know. At least you could take a look at what the farmers are planning. Maybe some of them have ideas that the rest could use. Maybe someone could go look at the grazers and see if there's something we can do to keep them out of South Valley."

"Someone like who, Guy?"

"I don't know. Have you asked any of the scouts?"

"You mean like you personally?"

Guy felt his face grow red once again. He really hadn't considered volunteering himself for the job. But he was a scout, and he didn't exactly have any other pressing responsibilities—with the exception of maintaining his year-old romance with Emily.

"Well, now that you mention it. . . ."

"Why did you have to volunteer?" Emily said later, on the bus ride down to the Main Post. "Now you're going to be gone for weeks."

"It won't be that long."

"But Guy, spring break only lasts seven days. By the time you get home, I'll be back in school."

"I'm sorry, Em. But by the time your holiday is over, the grazers will already be here. If we're going to do something useful, we need to do it now."

"That's what you always say."

"Why? Is there something you had planned for the vacation?"

"Just this," she said, pulling him closer and planting her lips on his and pressing her thigh against his leg. He enjoyed it for a moment, then caught his breath when she relaxed her grip on him.

"For seven days?"

Prime Site, the area chosen by the scouts for the first colony on Asgard, was a square about 150 kilometers on a side. Located on the east coast of the planet's largest continental mass, it contained three mountains, two valleys and a wide variety of flora and fauna.

A short Asgard year earlier, the breakthrough colony had arrived, all but one of the twenty colony ships successfully completing the 25-year journey from Earth. To the colonists, the trip had taken only a moment. But for the rest of the universe, they had traveled for two and a half decades at light-speed to reach their destination.

They'd made orbit around Asgard and begun their landings—fifty-seven colonial dens. Some of the modular economic units were specialists in management, some in education, others in manufacturing, construction and transportation. About half the dens were farmers, the other half were there to provide the special services required by an advanced technological society. With

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twenty-five years separating them from home, they had to bring along everything they would need and much that they didn't.

Especially to a world like Asgard. While Prime Site enjoyed a climate that was pleasant and inviting much of the time, Asgard was gripped in a planetary glaciation similar to that enjoyed by Earth 40,000 years earlier. The colonists had come ready to do battle with an environment that occasionally treated them to blasts of icy winds, white tornadoes, sudden summer squalls, and all manner of unpredictable tempests.

A year earlier, Guy had led a patrol of scouts up the long trail from Main Post to Glacier Valley, camping out overnight along the way in the wild emptiness of South Valley. Now he and Emily rode a bus down the road that followed the old path, passing farmsteads and households, villages and gardens, all the signs of the rich life the colonists had planted in the six months since the landings.

Their arrival at the scout post was cause for a wild celebration among Guy's three younger brothers, Walt, Billy and Tad—and even for his parents.

Guy's father, Philip, smiled and stayed in the background while the rest of the family mobbed poor Emily. She hadn't been at the Main Post since before Colony Day, when the 95,000 settlers from Earth began the long process of landing from orbit. She and Guy had met when Emily came down with her mother in one of the first pathfinder teams, diverted to the Main Post when a landing beacon failed up near Glacier Valley.

"It's so nice to have another woman around here," said Guy's mother, Joanne. "You don't know what it's like having to live with five men."

Emily shined at the attention, and even gave Walt a sisterly kiss on the cheek in greeting. Her first night on Asgard, he had stolen a kiss from her, only to have his older brother come along and steal the young lady away. Guy was happy to see Walt blush—there was no jealousy there.

She even had little gifts for all the boys—a slingshot for Billy that her own brother had donated, a book disk for shy, sensitive Tad, and a bright red headband for Walt. And for Guy's mother, she had an even greater gift—a small bag of makeup, including lipstick, powder and eye shadow.

"Oh, my goodness, Emily, these are beautiful. You wouldn't believe what we had to put up with before the colony arrived. The men who organized the scout team never even thought about bringing along cosmetics. I'm surprised they even thought of giving us soap. But what shall I do with all these?"

"I'll show you how to use them. You're going to need to know how when the special services and apparel dens start production this summer. There's even going to be a beauty parlor in Center Township, you know."

"I know. I can't believe it. When I was growing up, it was always hard to tell the boys from the girls until the boys came of age and had their hair trimmed. Maybe now the kids'll start to take more interest in how they look. I know there are so many times I've wanted to fix myself up and feel like a woman for a change. . . ."

Guy lost his girlfriend to his mother for the rest of the afternoon. He only

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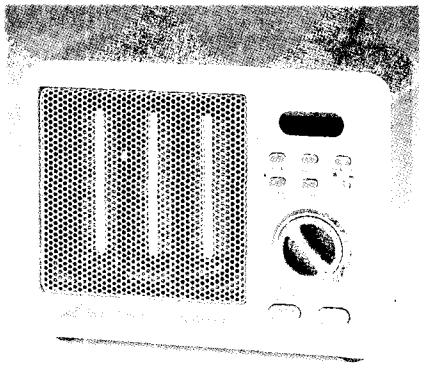

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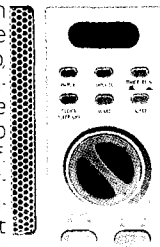

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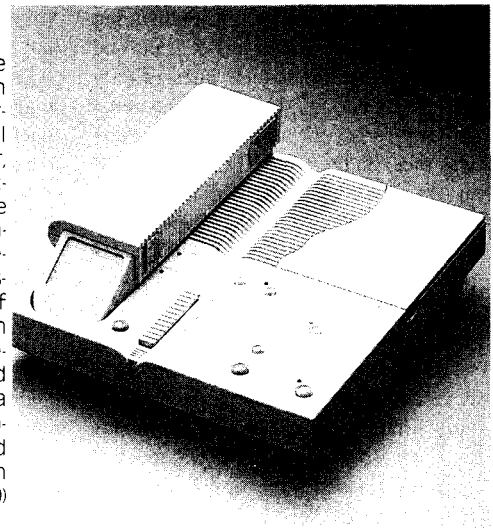

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recovered her at supper, when they put on a special meal with lots of fruits and vegetables to honor their guest. Emily was a vegetarian, something she never let Guy forget for a minute when there was meat on the table. He filled himself up on roast blueneck with gravy and yams with spineycone glaze, despite the undisguised glares she aimed at his plate.

"It's too bad we don't see more of you," Guy's mother said as they finished up the meal and the younger boys began to take away the dishes. "And Guy's hardly around here on weekends anymore, so we don't get to talk much."

Emily flashed a coy smile, and Guy felt embarrassed.

"I know how you feel," Emily said. "He's going to take off on me in the morning, you know."

"He is? What for?"

Guy explained how he had talked himself into investigating the grazer problem for Emily's mother, and she and his father voiced their own support for the mission.

"While you're at it, you should stop by up at Highland Post," Guy's father said. "Stop in and check on Grampa Bob. I hear bad news about him. You were always close to him, maybe you can figure out what's wrong."

"I'll do that, Dad," Guy said, wondering what the old scoutmaster was up to now.

"We'll leave you two alone now," his father said, ushering his surprised wife from the table and into the kitchen to leave Guy and Emily alone. They went outside, where a premature breath of spring had blown up from the southeast. It brought warm air to the South Valley where snow had fallen only a day before.

Emily shivered against him, and he hugged her closer. They didn't talk much after that, but found other ways to pass the evening on the front porch of the Stanger household. Later, after the rest of the family had turned in, but while the world was still painted with Ruby's faded red glow, they went to bed.

TWO

Guy was always left breathless by the sight of Highland Post.

While the low buildings of the Main Post sprawled across the rolling savannah plain, and the Glacier Valley Post was laid out neatly along the shores of Glacier Lake, Highland Post was built along more vertical lines. The main lodge rose in tiers, framed by the hundred-meter greenwood trees, backed by the pale cliffs that fell from Mt. Thor. The tall cabins were built of greenwood timbers and pine logs, with steeply pitched roofs and narrow windows. Stairs and walkways connected balconies and porches—some of them mounted on the trees themselves. The integration of artifice and nature made the whole place seem as fantastic in its character as it was in its dimensions.

Guy was almost ashamed to approach it in a bus.

Only a year ago, the only way to come upon Highland Post was on horseback. But since then, the colonists had laid their roads and unpacked their trucks and buses, and the transport dens had started shuttling people around from one end of South Valley to the other.

The changes had even Guy Stanger's

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young head spinning. He could imagine how Grandpa Bob must feel.

He found the old man in a strange little apartment cut into the bole of a greenwood not far from the base of the main lodge. As he had told Guy many times, he would have preferred living higher up, but he was too heavy around the middle to go climbing up and down forty meters of stairways four or five times a day. Guy thought he was stretching the truth a little bit, but never said so.

"Hello, young scout," Grampa Bob called as he stepped out onto his front porch. "Heard any good Great Spirit stories lately?"

"Not since the last one you told me, Grampa Bob. And that was when I was still just a cub."

"Come on in here and have some tea anyway. Keep an old man comfortable in his declining years." Guy stepped into the dim chambers that the old scoutmaster kept.

Grampa Bob was one of the original scouts who came from Earth ninety-three years ago. He'd been just a little older than Guy when he left his home world for the unknown challenges of Asgard—the planet didn't even have a name then, it was just Mu Cassiopeiae A II. There were other old-timers still around, but Grampa Bob stood out from the rest. He'd made a point of creating and retelling stories about the Great Spirit and his plan to lead the good people of Earth away from the tired old world onto the untouched planets of other stars. The adults in the scout den hadn't taken him very seriously, but the kids had followed him with eager innocence. Once upon a time, Guy was one of those kids. And now, barely three months since his thirty-fifth birthday, with the stubble just growing back where his hair had been shaved above his ears, he still stood slightly in awe of the white-haired scoutmaster.

"So what brings you up to this end of the valley? I haven't seen you since before Colony Day."

He told Grampa Bob about the grazer problem—and what he hoped to do about it.

"That's a pretty tall task to take on yourself, Guy. I hope the colonists turn out to be worth it. Personally, I have my doubts."

"I know, sir. You've made that clear more than once."

Grampa Bob looked serious for a moment, then shrugged. "Don't take it personally, boy. I'm just a cranky old man who worries too much. I hear you've taken up with one of the colonist girls. Do you like her?"

Now it was Guy's turn to look serious. "Of course I do, Grampa Bob. I never felt this way about anyone before."

"What are your plans for the future?"

"Well, sir, I hadn't thought too much about the future yet. Things have been pretty hectic since the colony landed."

"You'd better start, then. Things are only going to get worse, you know. If you wait around until they ease up, you'll be as old as me. There's a lot more changes coming in the next few weeks—more than you've seen so far, I'd wager. And I'd win, too."

"What kind of changes, Grampa Bob?"

"Changes in the scout den, for one. People have been talking pretty serious

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about the future of den Iroquois. There's a lot of different ideas being tossed around. I've got a few of my own, without getting too bold about it. Now that the colonists are here, we've got to make some hard decisions."

"I know. . . ."

"I've made up a new Great Spirit story, Guy. I want to tell it to you."

Guy felt a warm rush run up his back. He recalled the earliest days of his childhood when Grampa Bob first told him the Great Spirit stories. When he was still a youngster, Guy had believed the stories and thought the white-haired old scout was the wisest man in the world. His awe was a little more restrained now, but not his respect.

The stories were always fun—but just a little bit more. They made the scouts feel like they had an important job to do on their new world, like it was up to them to protect it.

"I'd like to hear it," he said.

"The Great Spirit is with us," the oldster intoned.

"And we are with the Great Spirit," Guy replied.

"Long ago, the Great Spirit walked upon the Earth and made it great and bountiful. Clear waters sprang from the ground where he walked. Fruit grew where he paused. Forests arose where he slept."

"Great was the Great Spirit."

"He walked with the other spirits of the world. The Spirit of the Wind, the Spirit of the Sea, the Spirit of the River, the Spirit of the Forest, and the Spirit of the Ice.

"But this is the story of a new spirit—the Spirit of Empire. This is a different kind of spirit, not a spirit of nature, but a spirit of man.

"Once upon a time, man himself was a spirit of nature. He lived in peace with the other animals of the forest and field. He took what he needed from the soil and gave back what was left. His numbers were few and his thoughts were many. He lived in small cities where he learned the ways of nature and the Great Spirit, where he practiced art and medicine and science and where he cultivated the virtues that made his spirit grow.

"But things do not remain the same forever. The small cities grew, until one of them became larger than the others. And there, the Spirit of Empire arose.

"The larger city began to believe that it was a better city and that it was meant to rule over the others. It raised up an army, conquered and enslaved its neighbors, amassed wealth and overwhelmed all of the civilized world.

"No longer did man live in peace with nature. Now he turned against it, against his fellow man and against himself. He stole nature's treasures, poisoned its air and water, slaughtered its children and destroyed the system of fragile balances that the Spirits of the Wind, the Sea, the River, the Forest and the Ice had created through ageless time. The other spirits turned against the Spirit of Empire and one by one they worked to undermine his work. The Wind Spirit blew down the city walls. The Sea Spirit rose up and flooded the city streets. The River Spirit overflowed its banks and washed away the city bridges. The Forest Spirit and the Ice Spirit fled from the city's edge to leave it harsh and barren.

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"But the Spirit of Empire would not be denied. He laughed at the others, built new walls, new streets and new bridges. He reveled in the emptiness left by the forest and the ice. And he reached around the globe to increase his power beyond all imagination.

"The other spirits grew sad at the sight of what the Spirit of Empire had done to their world. And when the sound of their crying was heard by the Great Spirit, he came to them and told them of another world where they could go.

"Among those spirits was one who cried louder than all the rest to see what the Spirit of Empire had done to old Earth—and that was the Spirit of Man. He told the Great Spirit that he cried the hardest because he was the closest of all to the spirit of Empire. At first, the Great Spirit did not want to bring the Spirit of Man along with the rest. He was afraid that he would give rise once again to the Spirit of Empire. But the Spirit of Man promised that he would serve the other spirits and protect them from the evil that they had suffered on Earth. After talking for many days, the Great Spirit finally agreed to take him along. He gathered all the spirits together on a great starship and carried them away. They traveled for twenty-five years until they reached Mu Cassiopeiae, where they found a planet named Asgard.

"And all the spirits went down to the planet and decided to live there, in peace and harmony. But then one day, the sky above Asgard was filled with spaceships that carried many men and women. The Great Spirit looked upon them and grew sad, because he realized that the Spirit of Empire had followed him to Asgard. And he knew that there was no way to escape from Empire, no place to run, no place to hide. No matter what the Great Spirit did, Empire would follow him and take what peace he thought he had achieved."

Grampa Bob fell silent, and Guy swallowed hard. All the bitterness and anger of the old man cut through to his heart, leaving him feeling empty and hurt. This was not a story Guy wanted to repeat to the children of Asgard. It was a story he never wanted to hear again. But at the same time, he knew he could not tell that to Grampa Bob.

"Is that the end?" he asked suddenly, not knowing why.

"I think so . . . I don't know. I've considered other endings. The one that I like the best has the Great Spirit lead the other spirits into the wilderness instead. It's not as pessimistic. But it's not what I believe, either."

Guy was silent for a long time, turning confused thoughts and feelings over in his mind. Grampa Bob just sat in his chair, his arms hanging at his sides and his head slumped down, eyes pointed at the floor. At last, Guy gingerly asked another question.

"Are you really that disappointed by the colonists, Grampa Bob?"

The old man looked up, suddenly piqued by the sensitive inquiry.

"Not all of them, I guess. There are a few that may give you reason for hope. But not enough, I think." He looked at Guy with weary eyes seated in a nest of deep wrinkles. "You've seen the library videos of the great arcologies of old Earth, haven't you Guy?"

He nodded, picturing the giant towers

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of steel and glass, the geodesic domes and mile-high spires of the great monuments to human sacrifice. He knew that Grampa Bob was talking about them when he told of the great cities that gave birth to the Spirit of Empire.

"Well, what the videos don't show you is how those things looked when I left Earth. They don't talk much about Mexico City, do they?"

"No, sir."

"They say it was the earthquake that did it in, but that place was in decline long before them. I've been to Mexico and I've seen what those things look like when the life has been knocked out of them. You cannot imagine the decay and the human rot that is left behind—and I'm talking about living rot, not dead flesh. The criminally evil men and women and the destruction they perpetrate on themselves and others. The distortion and perversion of the human spirit under the wreckage of spoiled greatness.

"Guy, they want to bring it all here. Give them a few centuries and they will recreate the whole thing on Asgard. There'll be another Mexico City and another idol to the Spirit of Empire on a world that was perfect and pure when we got here. I wish I could stop it, but I know there is no way. There's just no way. . . ."

Guy felt his throat burn as he choked back his emotions. He wanted to say something to help restore the old man's faith, but the reversal of roles was too much for him. Grampa Bob had always been the one who gave him faith, who assured him that there was a purpose of life and a reason to wait all those years for Colony Day to arrive. He wanted to give some of that hope back to the man, but he just didn't know how. He felt empty and powerless and angry at his own inability.

And yet, somewhere inside himself, he knew that Grampa Bob was wrong.

He just had to be.

THREE

An hour later, while he was standing in line at the commons, waiting to fill a tray with fuzzasaur soup, baked arracacha, spineycone sauce and pork chops, Guy looked up to see a familiar face—Lyle Sanderson, one of the scoutmasters from the Main Post.

"Hello, Guy, what brings you up here?"

"I came to visit Grampa Bob," he said.

"What a coincidence. So did we. Come on over and sit with us while you eat, why don't you."

Guy felt uncomfortable socializing with the senior scout leaders—especially after the session with Grampa Bob. But he found out quickly that it was more than a social occasion. He took a seat across the table from Sanderson and Eddie Gilmartin, another of the Main Post leaders.

"How is the old man these days?" Gilmartin asked.

"Tired, I think," Guy said. "He's awfully depressed abut the colonists."

"Sounds like he dropped a heavy load on you," said Sanderson. "I've been talking to him lately myself, Guy. If I were you, I would be very careful about letting Grampa Bob make you feel bad. It isn't fair for him to make young men like you carry his burden of bitterness and spite."

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"Or anyone else, for that matter," Gilmartin said.

"I know," answered Guy. "It's just that he's always been the one to show us why we we're here. And now it sounds like it was all wrong. Or at least he thinks so."

"Do you think so?" asked Sanderson.

"No, I don't. I think we have a lot more work to do on Asgard. And now that the colonists are here, we have to help them any way we can. But Grampa Bob seems to think they aren't worth it."

"It's deeper than that, young fellow," Gilmartin said. "That's why we're up here. There's going to be a High Council meeting. Probably next week."

"A High Council meeting? What for?"

"In a way, it's past due," said Sanderson. "And in a way it's too early. There's a lot of changes coming for the scouts. They've been simmering for a year now. We've got to decide just what the future holds for den Iroquois, Guy. Grampa Bob has kind of precipitated the whole issue though."

"How? What's he done?"

"He's stirred up a lot of people who feel a lot like him. They're not happy with the changes now that the colony's here. They're used to living alone on Asgard, got set in their ways. A lot of them are older, a lot of them are just stubborn. And then there's a bunch of kids that never stopped believing in him. He seems to have generated a spark under them, and Eddie here thinks it's got to be stopped or settled one way or another."

"I still don't understand," Guy said. "What's Grampa Bob want?"

"He wants to split up the den," Gilmartin said. "He wants to take a bunch of scouts out into the interior, apart from everyone else and set up his own post."

"I guess you don't mean like the posts at the Avalon Sea or near the Albion Mountains."

"No—I mean like alone, separate and having nothing to do with the rest of us."

Guy felt strangely uncomfortable, like someone was moving furniture around inside his soul. It was just one more in a long string of disruptions that stretched back a year to the landing of the breakthrough colony. For three generations, the scouts had been the masters and the caretakers of Asgard—barely eight thousand of them by the time the colonists arrived. But the overnight appearance of nearly a hundred thousand newcomers had changed every aspect of life for Guy and the rest of the scouts. Each time he thought things had achieved some kind of equilibrium, there was another terrible change appearing on the horizon. He didn't know how to cope with this one, though. The idea that the scouts could break up was more than he had ever imagined.

"If you ask me, he's just a mean, depressed old man," Gilmartin said, causing Guy's emotional defenses to rise within him, although he made no outward response. "I don't want to see his bitterness destroy the den. And if I can stop him, I will."

"Eddie wants to be sure we're all committed to continuing the mission of the den. Now that the breakthrough group is here, there's going to be new

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dens coming every couple of years. In twenty-five years, there's going to be another hundred thousand colonists. And in a hundred years there'll be two million of them. Those people are going to need some place to live and the scouts are still going to have to find sites for them. What Grampa Bob doesn't seem to realize is that this is just the beginning. We're going to be in business for a long, long time."

Lyle Sanderson tried to soften the harshness of Gilmartin's words.

"I think Grampa Bob knows exactly what we're facing, Eddie. But I think he has a lot of different feelings about it. You know, neither of us ever lived on Earth. He's not just old, he's from a different generation, a whole different way of looking at things."

"I think he's too tied up in the past. This isn't Earth, it's Asgard. We've got a big future to fill up. We can't keep looking back the way he does. Besides, what's he got to look forward to? He's over 135 years old. What's he got—another 15?"

The talk of Grampa Bob's mortality disturbed Guy more than anything. He didn't know if he wanted to sit and listen to this talk much longer—especially if Eddie Gilmartin was going to keep stirring up feelings he didn't want to face.

Luckily they were nearly finished with their meal. Guy concentrated on soaking up the last of the soup with a piece of bread while the two scout leaders continued their discussion.

"If the den does break up, then we're all going to have to make some pretty hard choices," Sanderson said.

"You may have to, Lyle, but I don't. I'm sticking with the way I was taught—even if it means moving on out to Avalon."

Guy felt buffeted by invisible undercurrents again. He was almost afraid to ask what they meant this time, but he spoke up once more. "What are you talking about?"

"What he means is that if Grampa Bob busts open den Iroquois, there are some scouts who want to stay behind and join the colonists. Lyle thinks he may be one of them."

"I'm just saying it's an option, Eddie. We can help the colonists just as much by staying here and teaching them what we've learned as we can by striking out into the wilderness."

"Well if I can get Grampa Bob to forget his crazy ideas, we won't have to worry about it, will we?" Gilmartin said.

"No, I suppose we won't," Sanderson replied. But he shot Guy a look of despair that left the young scout feeling that the choices facing den Iroquois were going to become quite personal before it was all over.

And Guy realized with a sudden sinking feeling that he wasn't sure he would want to leave South Valley behind if it meant that Eddie Gilmartin was going to be the scoutmaster. . . .

Guy spent the night at Highland Post and in the morning he drew a horse and supplies from the barn and set out towards the south.

A light drizzle was falling when he left the high cabins of the post behind. He pulled his poncho tight around his neck and let the hood drop low around his face. The sound of the rain drops splattering across the weatherized fuz-

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zasaur skin, the sound of the horse's regular breathing and the steady rocking rhythm of his gait allowed him to retreat into a tiny, self-contained space, apart from the larger world around him.

Riding alone, without care or worry, made up for the tumultuous emotional upheavals of the day before. He didn't want to think about Grampa Bob, or the breakup of the scout den. He didn't even want to think about Emily and her mother and the poor grazers that would soon be making their way north.

He just wanted to ride, fulfilling a role he had sought all his life. Being a scout meant going out into the world and seeing what was there to be seen. It meant exploring and investigating and studying and recording. Not necessarily for anyone's future use, but for its own sake. Like Adam naming the animals in the Garden of Eden. Sure someone could use it some day, but he couldn't know who or how. So he just had to do that one job well and not think about how it fits into everything else. That was the one constant that remained undisturbed in Guy's life and he held onto it as tightly as he knew how.

It took him all morning long, four hours, to follow the High River down from the Highland Post to the ferry across the South River. During that time, the rain let up and a steady wind blew up out of the northeast. Thick with tropical heat and humidity, it slapped at his face with a heavy hand.

Weather on Asgard was always exciting and never dull. If you didn't like it, wait just a while it would always get worse. The sun burned off the remaining low clouds that had been the source of the morning rain. Great shafts of gold and yellow cut through the sky, raising steam from the wet plains and cooking through Guy's poncho. By the time he reached the South River, he had stripped down to a vest, stowing the poncho behind him in a handy spot in case the rain returned.

The ferry was on the other side of the river when he rode into the landing and tied up his horse. He pulled out his pack and unwrapped a sandwich he'd made for himself before leaving. While he ate, he watched the flat barge work its way along the cable from the south bank to the north. The river was slow and lazy right now, and the cable ran up across the mudflats on either side of channel to its anchorposts.

But in a few weeks, when the snow along the mountains and ridges began to melt under the withering heat of the spring thaw, it would grow into a raging flood. A few crowds of grazers would make it across before then, but the rest would wait until the spring melt subsided before turning into a flood of their own.

After a few minutes, the ferry moored alongside a floating dock. Guy took his horse by the reins, wrapped his poncho over its eyes, and walked it out to the end of the dock to meet the ferry. The ferryman was an old man who said he was from den Pontiac, the transport den, but didn't have much else to say. It was just as well—Guy didn't feel like talking.

Pushing the barge was an electric torque induction motor powered by a portable fusion pack. A long shaft extended from the motor with a propellor on the end. The old man disconnected the motor from its mount and manhan-

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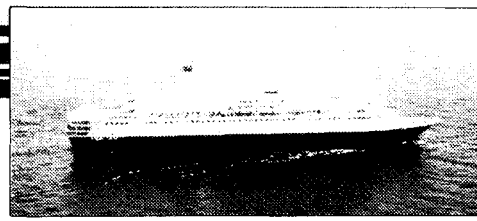

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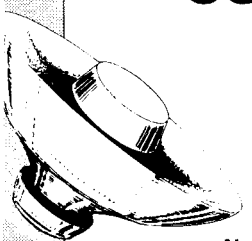

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dled it to the other end of the ferry. Then he had Guy lead his horse down into the center of the deck.

The ride across was uneventful, and a few minutes later Guy led his horse up the dock on the far side. He was on his way quickly, his spirits rising as the sun burned down on his face and arms.

To the east lay an empty township, unoccupied by any den, its space reserved for future growth. Off to the west somewhere, on the other side of the Lower River, was Roanoke township, where farmers from Virginia shared a village with den Halston, the clothiers. Guy could see a line of trees on the horizon that had to mark the river. Beyond it were sixteen hundred farmers spread out over a square sixteen kilometers on a side. Somewhere in there was a village center where den Halston had set up its textile shops.

He was mildly curious about what that village might look like but his path today took him too far west to indulge his interest. In a short time, however, he found himself crossing through much of the township and getting a good look at what the farmers had accomplished since their arrival a little less than six months ago.

Roanoke seemed to be a typically American den that had developed its township in a typically American manner. The square had been divided into smaller squares of sixty-four hectares each and every family was given a square and a house. The little frame buildings dotted the plains, and even though they didn't make a perfect grid, Guy could sense the measured regularity of their spacing.

Some families had put up greenhouses, some had built sheds and coops and barns, some had corrals and fences that held livestock—beef and dairy cattle, sheep and horses. There weren't any crops in yet, but he found quite a few farmers taking advantage of the warm weather to begin breaking the earth.

Guy was fascinated by the way their windlass plows worked. The plow was attached by a cable to the windlass on the front of a farm truck. The windlass reeled in the cable and took a tow on the plow. The result was a neatly turned field where the earth wasn't pounded down and broken in by the heavy weight of tractors and other machinery.

About 1500, as the sun reached the top of the sky, the weather began to turn nasty. Thunderheads climbed towards the heavens, obscuring Mt. Thor to the northwest and cloaking the Vogelsberg Ridge in the grey gauze of distant rain. Cold upper level winds, straight off the glaciers to the far north, sliced through the billowing crowns of the rising storm cells. Bold flashes of blue lightning danced at their feet.

He took refuge in the nearest farmstead as the squall line marched steadily towards him. He thought he could beat the rain to the barn that he saw there, so he didn't slow down long enough to don his poncho. He was wrong.

There was no one in the yard as he galloped in. Great cold drops of rain bombarded the dusty ground and smacked into the back of Guy's head. They were followed by a short, sudden rush of sound, then the air turned into wave after wave of falling rain.

He was drenched by the time he reached the barn door. Suddenly a blurred shape appeared through the

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door, grabbed Guy's horse by the bridle and pulled it inside.

It was as if someone turned a switch. The pounding roar of his blood in his ears was replaced by the soft drumming of the rain on the rooftop. It echoed throughout the large dry space, muffling the sound of nervous livestock. Guy wiped his eyes, then saw the line of cows that ran along either side of the barn, all tethered to the wall and standing in muddy straw. Holding the reins of the horse was a young woman, no more than twenty-five.

"Are you a scout?" she asked.

"Yes," Guy said. "Are you a farmer?"

"Sure am. Eddie Lee. This is my farm—my dad's farm. He's over in the other barn with Uncle Dick. That's some storm."

"It's going to get worse," Guy warned. He looked around. The barn seemed to be built on a slab foundation of fused silicon. "Is there a storm cellar in this place?"

"A what?"

"A cellar—a hole in the ground with a cover on it?"

"No, sir. Not that I've ever seen, anyway."

"Too bad. Well, we probably won't need it."

Eddie looked at Guy quizzically, and Guy realized the woman wasn't sure if she was being set up for a joke. He also realized that he was being a little bit melodramatic.

But only a little bit. A few minutes later, the rain let up, Guy had tied up his horse, and he and Eddie stood at the barn door looking out across the plains at a distant thunderhead.

"Look over there—see where the clouds get thicker at the base of that storm? Watch it for a few minutes."

They did, and slowly but steadily the clouds thickened, dipped earthwards and dropped a thick black siphon onto the ground.

"Twisters. Are you sure there isn't a storm cellar in this place?"

There wasn't, but it turned out to be unnecessary. Guy felt a little ashamed of scaring Eddie, though. After all, the Main Post had sat unharmed in its current location for ninety-three years without ever being hit by a tornado. There was no reason to believe that this farm was likely to be any less lucky.

Eddie calmed down the cows by walking the length of the barn and talking to them, something that amazed Guy more than the tidy little plows. The Lee's farm was a double spread, shared between Eddie's father, Ned, and her uncle, she said. The feed corn for the cattle was going to be grown on the bulk of the two sections.

"What about the grazers, though?" Guy asked.

"The what? You mean the fuzzasauruses? We've got them licked. Come see this. . . ."

She brought Guy over to a corner of the barn and showed him a small plastic box. "What is it?"

"A holograph projector. Watch." She fiddled around with it for a moment, then suddenly a maxidon two meters tall with a three-meter tail appeared in the middle of the barn. Guy jumped back, then realized that it was not moving. "The guy who sold it to us called it a scare-a-saur. I can't wait to see if it works."

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"If it doesn't have the scent, I'm not sure it will," Guy said.

"Oh, we've got that. Right here." She pulled a plastic jug out from behind the projector. Inside was a viscous brown fluid. "They gened it, then pumped it through the bio-factory up at the village. We're supposed to paint it on fence posts around the cornfields."

Guy shook his head. "Sounds ingenious."

Eddie shrugged. "I don't know if any of it's going to work. Daddy and Uncle Dickie argued about it once, but they never settled who won. Daddy thinks it will. Uncle Dickie doesn't."

"I know how your father must feel, but I'm afraid my vote would go with your uncle. I'll believe it when I see it."

The squall line passed by and a brisk northwest wind fell in behind it. The air turned dry and chilly and Guy went through his pack for warmer clothes. Then he mounted up and walked his horse into the yard.

Eddie looked up at him with a bit of awe and amazement in her eyes. Guy felt uncomfortable, but didn't know what to say. "Tell your father I said to build a storm cellar, will you?"

"Sure thing, Mr. Scout. Thanks a lot."

It was late noon, 1800, before Guy stopped for supper.

According to the map in his laptop, he was probably near the junction of Roanoke, Dubuque, and Geneva townships. He could see the small square shapes of farmhouses in the distance, and here and there the smoke from cooking fires smeared the air.

Along the northern horizon stretched the great wall of rock and forest that split the Prime Site from east to west, separating the two river valleys, Mt. Thor to the west, Mt. Loki in the east, and the Vogelsberg Ridge running between the two. Off to the south were lower ridgelines and a series of small buttes rising sharply from the savannah plain. Forests covered the high ground that rose above the plains.

Then, in the distance, he heard the hooting sounds of a crowd of bluenecks. He scanned the plains with narrowed eyes, then caught a glimpse of them through the haze about four kilometers away—too far to get any idea of their numbers. He doubted if it was the first to make it this far north. The migration had already begun days ago.

Somewhere beyond that crowd to the south was his destination—Fuzzasaur Pass and the pathway to the wide open lands of the tropics. Guy figured he could reach it before dark if he pressed on—he had another six hours of daylight. As it turned out, he was wrong, but not because of any miscalculation on his part.

FOUR

The fence was mean and ugly, sharp wooden stakes linked together loosely with coiling ribbons of metal. It stretched from the grey cliffs of a butte to the west over a rise to the east where it dropped from view. The metal ribbons looked razor sharp to Guy, and they were full of barbs and kinks. He felt shivers run up his back at the sight.

And on one of the stakes was the limp body of a female blueneck, its fur matted with blood.

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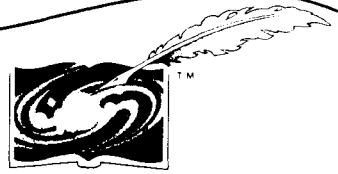

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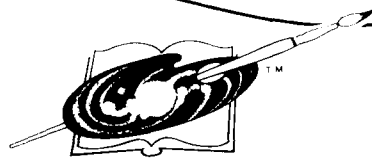

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Guy tried to imagine how it could have happened. Bluenecks weren't terribly smart animals, but he didn't see how it could have run into the fence by accident. But then he remembered the sight of a crowd of the grazers pushing and shoving one another to get at a chite mound—not to eat the little bugs, but because of the beastweed plant growing out of it.

There was beastweed all around here. The poor creature stuck on the fence must have been pushed there by the rest of the crowd.

But there was another, more crucial question that went unanswered—where had the fence come from?

He rode for an hour along the vicious-looking barrier until he came to an opening. A gate blocked a rudimentary gravel roadway running through it, and a single unarmed farmer stood watch over the gate from a small wooden shack.

Guy hailed the watchman, but was surprised by the reply.

It was a word in a language he had never heard before.

He waited while the watchman returned to the shack and engaged in an excited conversation with an unseen companion—unheard as well, leading Guy to suspect he was on the radio. Then the watchman hurried back to the gate, opened it, and beckoned to Guy to come through. He smiled, pointed up the road and urged the scout on. Guy waved to him as he nudged his horse into a trot and hurried away.

It didn't take him long to notice the different layout of this foreign township. Instead of dispersed farmsteads centered around separate houses, this den was organized around small villages, with the fields marked by stones, but not occupied by their owners. The village he came upon was full of houses, sported a few barns and warehouses, a herd of cows, a chicken farm and a honeyworks. And a bakery, he realized as he rode into the rich smell of baking bread.

He found his way to the main lodge at the center of a village green where he was greeted by a trio of men. He dismounted, tied his horse to a convenient rail and walked up to meet them.

The first two spoke the same foreign language that the gatekeeper had. Guy had checked his laptop and saw that this was den Kindrat, a Ukrainian farming den. He assumed they were speaking Ukrainian, but there was no way he could know for sure. From their smiles, he also assumed that they were friendly.

The third man hung back, waiting until the first two had exhausted their supply of salutations, then stepped up.

"Hello there, Scout. My name is Stepan Soroka. Welcome to Kindrat Township. The fellow on your right is Vasyl Yurchyk, the den leader, and the one on your left is Mykola Ploschak, his assistant."

"Hi. I'm Guy Stanger. I'm a scout. Are you the only one around here who speaks English?"

"Just about. But then, I'm not a member of this den. I'm here with the Kolbergs."

Guy's exposure to evil had so far been limited.

There were a few bullies among the scouts at Main Post. Henry Schmidt was one—a big man, only a few years older

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than Guy, who would push people around. Some people liked that kind of thing. The discipline of the scouts was supposed to be subdued and casual, but a few made it stiff and inflexible. Henry was one.

And then there was the renegade scout LeClerc, who had assaulted Jennie Gilmartin last year at Glacier Valley Post. Guy remembered the way LeClerc had squirmed under questioning and begged not to be put into exile.

But there was something amateurish and improvised about the moral weaknesses that afflicted those two. Soroka seemed much more refined and practiced in his evil than anyone Guy had ever known. He suddenly found it easy to picture what Grampa Bob must have been talking about when he described the ruins of Mexico City on old Earth.

It was not so much Soroka's demeanor or his tone that set off alarms within Guy's moral sense. It was that he was here at all.

The Kolbergs and their associates were not from Earth, but from somewhere much closer. They had come to Asgard from the Tikarahisat colony at Eta Cassiopeiae, only six years away, arriving just before the breakthrough colony. They'd been trying to establish themselves on Asgard as helpers and builders, ready to offer their experience at establishing a colony.

But the Kolbergs had a vision of the new world that Guy found frightening. When they first arrived, they had proposed concentrating all the specialists in one city in the middle of South Valley. They would have had the farmers clustered around the urban center with no room to expand and ignored North Valley. The Kolberg plan would have recreated the unequal relations of the old economics of Earth, with a high potential for growth and development, but with just as high a potential for failure and internal decay. In any event, the colonists adopted a more dispersed landing plan that offered more security, survivability, and sovereignty to the individual dens.

Unfortunately, Guy realized the more he saw of den Kindrat, that some dens were free to do things that just weren't right by anyone's book.

Soroka explained the fence.

"Back on Tik, there's a herd animal we call the vishnu. They're mammaloid, shorter than the fuzzasaur, but with more bulk, with bulging skulls and wooly fur. They run in herds—number in the thousands each. The colony's prime site is a wide open plain sort of like this valley. The only way we could protect ourselves from them was with the vishnu-break. We figured it would work just as well on the fuzzies."

"From what I've seen, it works real good," Guy said, trying to restrain his sarcasm. "I found a blueneck impaled on the section I first found."

"Yes, we get that back on Tik, too. Not nearly the same numbers here, though. Maybe we'll do better in the summer."

Soroka was a young man, not more than five years senior to Guy. He'd been a child when his family emigrated to Eta Cass, and he'd grown up in an agricultural den on Tikarahisat. By the time he reached manhood, the den had linked itself to the growing Kolberg organization—trading agricultural surpluses for manufactured goods. His den had

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always suffered from poor organization and weak finances, and the longer the deal went on, the worse off they became.

"So why did you join the Kolbergs?" Guy asked.

"It was my chance to get out of there. Power is strength—and the Kolbergs had power. I knew what they were planning to do and I wanted to go with them, to get off Tik and out of my own poor farmer's den. What kind of a life is that, growing things all day."

"And you wound up here?"

"I knew the language. My own den came from the Donbass. I think that was what kept us from prospering."

Guy, never much of a talker anyway, found himself just nodding silently as the man rambled on. But Soroka didn't seem to notice or care. He talked for his own entertainment, just to hear the words fall from his tongue.

"When we first made contact with den Kindrat, they were already organized along pretty strict lines. I liked that. They're here to do a job and they're ready to do it. Unified and committed. By the time they landed, we had helped them plan things out. The township farmland is held by the den as a whole. Now that spring is here, the farmers will begin working the fields according to a rotating schedule. The produce will belong to the entire den and the surplus will be a den asset."

The system sounded terrible to Guy, who believed in giving a man land of his own. It didn't sound to him like it would work—not without making the farmers responsible for their own work and their own land. He noticed, however, that the Ukrainians didn't seem to object. They were busy and happy, smiling and eager as they bounced along in their trucks on their way home from the fields.

But it wasn't the way the other dens were organized. And without a strong communication link to other dens, they had no way of knowing how far their thinking was from the mainstream of the colony. Mainstreams, more accurately. Since there were a few dens that wouldn't have found Kindrat so alien.

Soroka invited Guy to supper, and, reluctantly, he agreed. The reluctance came because Guy had sampled colonial rations before and avoided them like spoiled fruit whenever possible. But he wanted to find out as much as he could from Soroka.

The experience turned out to be more pleasant than he expected. They ate at the village lodge, a small wooden building with two large rooms and a loft. The fresh bread, still warm from the oven, made up for the bland pastey dishes concocted from the ration packages. There were some fresh fish, big, fat cherimoyas, a bowl of shriveled black potatoes that was probably the winter product of a greenhouse, and fresh butter.

Yurchyk and Ploschak sat on either side of him while they ate, speaking to him occasionally, through Soroka, to ask how he liked the food, but mostly carrying on a loud dialog between themselves across Guy's plate. When the meal was done, Ploschak went to a small wooden cabinet in one corner and returned with a large plastic jug and a tray of small glasses. They were made of real glass, not plastic, and Guy recognized them as heirlooms by the way

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the farmer treated them. He poured a clear liquid from the jug into each of the glasses, then resealed the jug and returned it to the cabinet. Then he passed the drinks around.

Guy copied the way the others tossed the liquid down in one gulp, but after he swallowed, his mouth burned with fire. He sucked air through his teeth and swallowed again, reaching for the plastic mug of water that he'd been nursing throughout the meal.

When he recovered himself, he found the others laughing and grinning at him as Soroka slapped him on the back. He began to feel a warm glow rise from the bottom of his feet and when it reached his eyes, he broke into a smile of his own. It only remotely occurred to him that this was some kind of homemade alcoholic brew and that he should limit the amount he consumed. He wasn't offered a second, however, a fact for which he was grateful.

When the ceremonial drink was over, Ploschak turned his attention to a pair of pretty blond women at the far end of the table and Yurchyk joined a group at another table, leaving Soroka and Guy to talk. The conversation quickly turned again to the organization of den Kindrat.

"The purpose of the colony is to grow and grow it will. We're going to knock Roanoke, Geneva, and Dubuque off the air," Soroka said. "The agricultural surplus we produce will become our leverage in the competition between dens. Instead of dispersing it among the membership, we will concentrate it and use it like a tool to increase our power.

"We have to be systematic, organized and committed, you know. A new world can be a deadly place. You should have seen what happened back on Tik. We run a long year there—456 standard days. That's more than twice one of Asgard's puny little years. We'd already settled in, started our crops and built our farmsteads that first year on the planet when the first vishnu came. In two days, they wiped out four months work. We lost the equivalent of six dens. That's when we started building the breaks to keep the vishnu out. Is it any wonder we want to help these people avoid the same kind of fate?"

"Of course," Guy said. "Although I'm not sure you've got the same problem with the grazers that you do with the vishnu."

Soroka didn't listen, but went on and on. He seemed oblivious to the moral impact of his advice.

"And this township is just one of many. We'll be working from a strong base once things get organized colony-wide. The ones who are smart enough to listen to us and join us will find that they will be strong, too. You'll see—the strong dens will lead the others, they'll build up the wealth of the colony. And the leaders of those dens will be strong and powerful men. That's what I want—strength and power."

All his life, Guy had been taught that every action one took, every job one assumed, would not—indeed could not—benefit just oneself. Although there were private indulgences that only benefited others in the most indirect way, in scout society everything had a unity of purpose and commitment that left almost no room for a split between the common and the particular good. All scout work, in the end, was to benefit

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colonists who would not come for many years—most of whom would follow centuries down the road.

"You know, the concept of private gain at the expense of others is hard for me to accept," Guy said. "I've always been taught that it was wrong to indulge my personal interests at the price of the den's interests. I've recognized it in all the things you people have done since you arrived on Asgard. But I always thought you knew that you were wrong. As I listen to you talk, I realize you do not.

"You speak as though it was the highest value to which one could attain. You believe that personal wealth and individual power based on greater accumulations of material products and goods is a suitable goal for a man to pursue. Yet you have no shame or remorse, only a starry-eyed and detached view of life as the pursuit of objects to be possessed."

"I suppose I do," Soroka said. "But your alternative, everyone working for the common good with everything they do? That's what we're doing here. Look around you. Everyone is working hard, everyone is working for the group. What more do you want?"

Guy's head spun and his tongue grew thick as he tried to voice his thoughts. "That wasn't what I meant. There's a difference between what the farmers of den Kindrat are doing and what I'm talking about. A whole different balance between freedom and duty. For your farmers, duty comes before freedom and is the opposite thing. For us, freedom and duty are identical."

"Oh go on," Soroka said, waving him away. "Don't try to fool me. I know you scouts all have title to landholdings out in the wild. Big lands, good lands. In good places. Don't you understand what I mean? You are richer than any of the farmers here in Kindrat will ever be. Of course you are free, because you are wealthy and powerful."

Guy thought about that. The Stangers did indeed have title to an area about ten times the size of a Prime Site township—about a quarter of a million hectares. The holding, with enough room for twenty dens, stood south from the joining of the Great Muddy and the Sierra rivers about a thousand klicks west of South Valley. There were forests of greenwood that reached two hundred meters in height, lakes of pure fresh water, fields of boulders and gravel where the glaciers had once roamed. All the scout families held them. Guy's uncle and two aunts each had a holding of similar size, which had once been part of a larger section held by Guy's grandparents—original members of the scout team. And that was only from his father's side. Through his mother's family, he had a share of a tropical holding on an island far to the east of Prime Site.

But he never thought of himself as being personally rich because of the holdings. Far from it. His father had explained it years ago—it was for the descendants of the scouts once they had completed their job and the colony was fully developed. He would pass his title on to his children and they would pass it onto theirs. By the time it was needed, there would be a farmstead for every scout.

"Don't deny it. You must know that

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what you call freedom comes from owning a whole world—at least until we got there, right? You never knew how rich you were until we brought some poor people here for you to compare yourselves to. You should thank us for this opportunity. But instead, we will be thanking you for your help. You could make a good deal of use out of that title under the right circumstances," Soroka said. "If you just give me a chance. . . ."

He probably could, Guy realized. But somehow he didn't want to imagine what those circumstances could be—despite the obvious invitation from Soroka to explore them in more detail.

FIVE

Guy left early the next morning, thinking about what life would have been like if the Kolbergs had not intruded on the Asgard colony. The more he thought about it, the angrier he became.

He was so preoccupied by his own thoughts that he was barely aware of the rhythmic gait of his horse and the cool pockets of night air that had pooled in the low grounds.

A warm wind had come up from the southeast and the ground had begun to rise from the valley floor before Guy took notice of his surroundings. He took a bearing on a line of trees that cut across the savannah plain—a sure sign of a river—and headed towards it to water his horse and to give it a rest.

Guy found the riverbank just opposite a crowd of duckasaurs. The wide-billed fuzzasaurs padded through the mud along the riverbed, digging up and swallowing yellow plants that grew there in profusion. His horse snorted at the smell of them, and their heads all shot up at once, swiveling on long necks to scan the area. Then one of them started hooting, and they broke into a trot, slapping along the mud. They splashed into the river in a mass and were downstream before Guy could reach the water.

The horse dropped its head to drink, leaving Guy to gaze out across the river and remember how to observe like a scout once again. He recognized the fuzzwort and beastthorn that covered the high wooded banks of the river. Baby's nest, frozen peas and robin eggs blossomed in the shadows of mossback trees and willows. A fleur-de-lis vine climbed a single tree as a forerunner of spring.

In the mud, he saw swamp toadies leaping from puddle to puddle. He remembered a fossil he had seen of a Thunder 'Phibian unearthed by a scout fifty years ago. The phibs were the only land creatures to experience gigantism in Asgard's natural history. The one Guy had seen must have stood two meters tall. The species had died out because it couldn't adapt when the ice age came. Their much smaller descendants would be asleep in the mud, back in hibernation, if the temperatures dropped off tonight.

In a few days, the river itself would be jumping with fish—native Asgardian species and the trout and salmon that an earlier generation of scouts had stocked in the rivers and streams of the two valleys, North and South.

And in the distance, he heard the hooting of bluenecks.

A few hours later, just before low noon, he found his first fuzzy trail. Crowds of grazers tended to walk in

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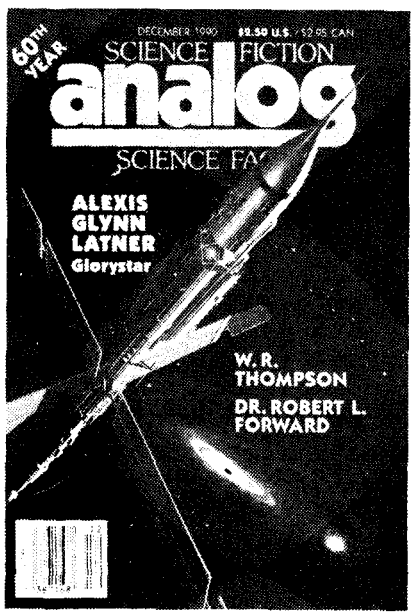

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single file and over the years, at least around here, they wore smooth, wide trails into the plain. In the open, once the grazers dispersed, such trails were less common. They appeared only where the natural terrain funneled the beasts together.

He followed the trail uphill, knowing that it would have to lead eventually to his destination—Fuzzasaur Pass. More trails fed into this one, and it eventually linked into a larger one, which led into the woods. Guy followed into the cool darkness beneath the trees, prodding his mount along as he encountered steeper ground.

Eventually, he emerged from the trees at the base of two basalt cliffs no more than a thousand meters apart and fifty meters high. The stone was weathered and smooth, stained yellow and brown, and split horizontally and vertically by laser-straight cracks that made it look quarried.

The fuzzy trail merged with a dozen others, melting into a wide highway that shouldered aside the thin conifers clinging to the base of the rock. The highway was clear today, but in a few weeks, it would be the busiest thoroughfare on Asgard.

Guy rode on through.

By the time he reached the other end, half a kilometer away, he was certain that he'd solved the problem of the grazers. But the solution he had found only filled him with sorrow.

The far side of the pass opened onto a treeless slope that dropped off to a rolling plain covered with savannah grass that extended to the horizon. In the distance, at the hazy edge of visibility, a line of trees marked the path of a river and here and there stood small groves of native conifers and scout-seeded fruit trees.

And stretching as far as Guy could see were fuzzy trails, branching and twisting and braiding themselves into one big highway that led straight to the path. The fuzzasaurs themselves were dispersed along the length and breadth of the network of trails. He saw them nestled down amid the green under the increasing glare of the midday sun, bluenecks, redcrests and silverstreaks, their long necks rising from the plain in little clusters.

He stopped his horse and dismounted, then walked down the trail towards a natural spring to allow it to drink. He pulled out his laptop and sat down on a fallen log. The entry on Fuzzasaur Pass was an old one, only a few years after the scout team first arrived. It had been written by Kenneth Monahan, who had only turned thirty-five a week before he left on his patrol. Monahan described the fuzzy trails, the mix of grazers, the maxidons lurking in the shade of distant trees. He could have been there just this morning.

He began to enter his own report on dens Roanoke and Kindrat and his evaluation of their plans for the grazers. Neither one was being practical or realistic. If the grazers followed the pattern of migration that they had since the coming of the Big Ice the fences at Kindrat township would only channel them into other townships, and the scents and holograms at den Roanoke wouldn't deter them for a minute.

If they followed the pattern of migration. . . .

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When he was done, he attached his ID code to the report and saved it for a later date when he could add it to the den database. Then he opened his saddlebags and pulled out the satellite phone, extending the antenna and activating the transmitter. A moment later, a ready light came on, indicating that he had made contact with the communications ship in permanent synchronous orbit over Prime Site. Then he punched in the personal number for Suzanne Baxter.

An intern picked up the phone and told Guy that Suzanne was teaching a class. He set the phone down and waited for her to call back.

While he was waiting, he studied the plain below with his field glasses. The collapsed optics and digital processing rendered a crystal-clear image of a crowd near the edge of a copse of trees. As he watched, he saw the crowd suddenly rise from their midday nesting place in unison, their heads all swiveled in the same direction. He followed their view to the trees, where a maxidon stood, its tail twitching as it worked its smaller upper limbs, grasping at the air. He could see the sharp claws on the maxi's lower limbs and could imagine the sound of its tail snapping with nervous energy.

The fuzzasaurs broke into a run, maintaining cadence and step as a unit. The maxidon took after them. They spread out and crisscrossed their paths in an attempt to confuse the predator, but it did not work. The maxi singled out one grazer on the edge of the crowd and followed it move for move. Then in a sudden burst of speed the big fuzzasaur was on top of the little grazer. There was a cloud of dust as they struggled, then the maxidon hunched over its prey.

Just about the moment that it sunk its teeth into the grazer's long neck, the satellite phone rang, rousing Guy from his long-distance rapture.

"Hello, Guy. What have you been up to?" Emily's mother asked when the connection was completed.

"Keeping busy," he replied. "I think I solved our problem."

"Oh yeah? You make it sound awfully easy."

"Do you know if the colony brought anyone with it who can work in stone?"

"I think we remembered to bring a few. What do you have in mind?"

"Let me tell you what I found first," he said. He told her about den Kindrat's vishnu-break and Soroka's amoral attitude about the grazers and the rest of the colonists of Asgard. "Soroka sounds pretty scary, doesn't he?"

"Everything about the Kolbergs sounds scary to me," Suzanne replied. "Now what's your solution for the grazer problem."

"Fuzzasaur Pass—it's the only door the grazers use to get into South Valley. All we have to do is close that door. The materials are already here—the rock in the pass comes in big brown blocks, already cut for us. It's just a matter of piling them up. The wall doesn't even have to be very high."

"Sounds awfully simple, Guy," she said. "But it may work out. Are you sure there's no other way for them to get around? What about farther up the valley, beyond Mount Thor?"

"Not according to the scout records. The valley is pretty well isolated from

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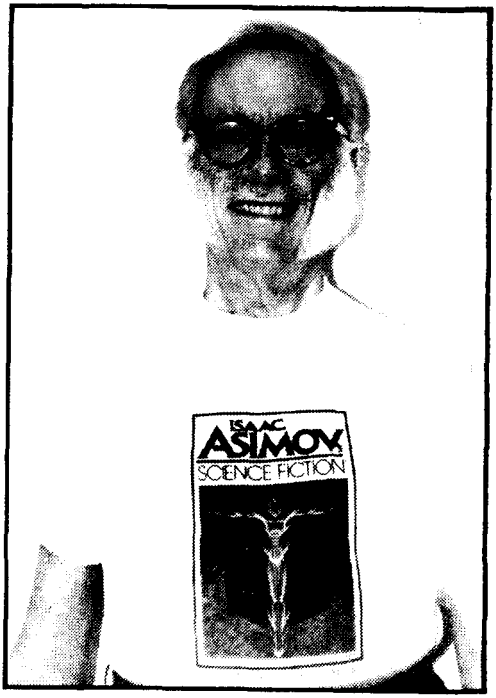

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the southern plains. This should do the trick."

And what a trick. He choked up at the thought of South Valley without the great crowds of bluenecks, redcrests, and silverstreaks. He would never again hear them hooting to one another at dusk or see them running across a field in single file. The savannah plains would be empty and lifeless, an alien landscape where humanity had pushed nature aside. And he would go down in history as the scout who made it possible.

"I'll believe that when I see it," Suzanne said. "But I'll also see about getting some stonemasons out to that pass. Tell me, Guy, when are you coming home? I have a daughter here who is not too happy about your travel plans."

"Tell Emily that I have some business to take care of at Highland Post before I head back that way. Scout business. There's a High Council coming up in two days and if I hurry, I should be just able to make it by then."

SIX

"We are one den with one purpose. The coming of the colonists has not changed that one bit."

Eddie Gilmartin's amplified voice echoed from the cliffs and woods around the Highland Post. From where Guy stood, at the base of the natural amphitheater, it seemed like every word went out and returned as garbled thunder. Eddie held center stage at a table with other scout leaders—Lyle Sanderson, Grampa Bob, and scoutmasters from Geneva, Northern, Skagerak, Snorri, Avalon, and Albion posts. The seats were filled with hundreds of scouts—most of the population of Highland Post was there along with quite a few from Main Post who had come up on the bus. The remaining seven thousand scouts on Asgard were tuned in over the satellite commlink the colonists had provided. Flanking the speakers were a pair of great bonfires, painting the trees and the scouts on the hillside orange and gold, great pillars of smoke rising into a sky lit by Rudy, Mu Cass' red dwarf companion.

"And no one should know that better than you, Grampa Bob," Gilmartin added.

The opening ceremonies of the High Council had been dispensed with quickly by scoutmasters who clearly had their thoughts elsewhere. They hadn't taken long to get down to business, but that was the way scouts always were. Guy was surprised by the directness of the debate—especially after listening to the colonists argue their own decisions out a few months ago. The contrast was reassuring. He may not have agreed with all that Eddie Gilmartin said, but at least he got right to the point.

"You came here voluntarily and took an oath that meant something, Grampa Bob. The younger fellows among us, like me and Lyle, are here by a happenstance of birth. We shouldn't have to teach you about a scout's commitment."

"Like you said, Eddie, I'm an old man. What more can I do for this den? What more can I do for the colonists? Don't I have a right to spend my last few years doing what I want to do? Haven't I earned that much?"

"Doesn't that depend on what it will mean to the den? You're not talking about going off on your own, Grampa

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Bob. You want to take a lot of people with you."

"That's their choice. I can't answer for them."

"And your oath?"

"My oath was to preserve and protect this world for posterity. Maybe I can do that better with a few scouts who are willing to live apart from the corruption of the colonists' world."

"Really, Grampa, do you expect—"

"Don't patronize me, Eddie Gilmartin. You and I both know that this isn't really about me and a few hundred starry-eyed boys and girls taking off for Albion. What you're really afraid of is a bigger split between the Prime Site posts and the outlayers. You know that if I'm allowed to leave the den, then the scouts at the Main Post and here at Highland are going to break away from you and the others. Isn't that right, Lyle?"

Lyle Sanderson cleared his throat and the rumble shook the leaves of the greenwood trees. "Not exactly, Grampa Bob. Everyone here knows that some of the scouts at Main Post are talking about settling down and starting a farm. A few have even talked about joining colonial dens. But that's only to be expected, and it doesn't mean that we're ready to break up."

"That's not the way I hear it," Grampa Bob replied. "Is it, Eddie?"

"That's not the point, Bob."

"Yes, it is, Eddie. That's exactly the point. Am I right or wrong? Tell us what you think about the breakaways? Isn't everyone at Avalon Post talking about how the Main Posters have all gone colonial cause they live next door to Center Township? Isn't that why you're so hot about the den maintaining its unity?"

"Bob, you're not going to get me to start an argument with Lyle. This is about you taking a lot of innocent kids out into the woods to live on their own."

"What do you think being a scout is all about, Eddie?"

"Grampa Bob, they're not going to have you to help them for very long."

That seemed to stop the old man in his tracks. Guy, too. He felt hatred in his heart for Eddie Gilmartin when he saw how Grampa Bob was hurt by the remark. Even if he was right about keeping the den together, Gilmartin was wrong about everything else.

But so was Grampa Bob. Did everyone at the Main Post want to be a colonist? Not that Guy had noticed. All this talk seemed so pointless to him. What was it going to accomplish?

And why was Grampa Bob trying so hard to turn the scouts against one another? That thought suddenly filled him with a sense of dread. The old scout really was working against both Eddie Gilmartin and Lyle Sanderson, dividing the den to achieve his own, private ends. That was wrong, against everything that Grampa Bob had taught the young scouts all his life. Why had he suddenly turned his back on his own principles?

"I'll be able to teach them what I know in the time I have left, Eddie," Grampa Bob finally answered after a long, embarrassing silence. Guy didn't find his tone convincing.

The debate went on for a couple of hours. Everyone got a chance to have their say, but no one changed anyone's mind. And the longer they went on, the more it seemed that Grampa Bob was

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going to get his way. Every argument they raised, he turned aside. Every objection, he met with another damaging criticism of scoutmasters who questioned him. Eventually, it became clear that there was no chance of stopping Grampa Bob. All the scouts could do was make the break clean and with as little heartbreak as possible.

Guy felt the ground shifting beneath his feet as the fear of terrible change took hold of him.

"Resolved: that Senior Scoutmaster Robert Scoggins be allowed to withdraw from den Iroquois with those scouts who wish to join him, and be it further resolved that they be provided with the equipment, supplies, and landholdings needed for their convenience and safety."

The clerk of the council, a large man from Northern Post with a voice that needed no electronic amplification, read from the laptop on the table before him. Guy felt his throat tighten as roll was called.

"Albion."

"Albion Post casts two votes in favor of the resolution."

"Avalon."

"Aye."

"Geneva."

"One aye and one nay."

"Highland."

"We cast all four votes in favor."

"Main Post."

"Two for, two against."

"Skagerak."

"Nay."

"Snorri."

"Aye."

"The vote is eleven aye, four nay. The resolution passes."

A knot in Guy's stomach tightened as he saw Grandpa Bob raise his hand to speak. The old man looked tired and not at all happy despite his victory. What was he going to say now?

"I want to thank all of you who supported me," Grampa Bob said when he was given the nod by the council president. "But I think that you've still got some unfinished business before you. Unless you want Eddie Gilmartin and Lyle Sanderson to snap at each other's heels for a few months before you call another council."

Someone at the far end of the table made a remark in a poorly muffled stage whisper, and Grampa Bob turned in that direction. "Don't tell me to sit down, Wilbur Gray. I haven't left the den yet and I've got something to say to you before I do leave.

"As long as the den is breaking up, we might as well have this out. There's two ways the rest of you can go. You can keep on with the mission of the den, live out in the wilds and break the trail for the colonists who will follow you. Or you can move into Prime Site and try living alongside them, teaching them what you know. Both of these are honorable callings and you may not all choose now, but choose you must. The time has come for the scouts on Asgard to all grow up. Our long innocence has ended. The world your grandparents and I left behind has caught up with us. And with it have come all the old sins—greed, lust, anger, and hatred. I don't think there is any way to avoid being corrupted by the colonists unless we break contact with all of you. Some of you may think you can compromise by keeping to the old ways, but the old ways

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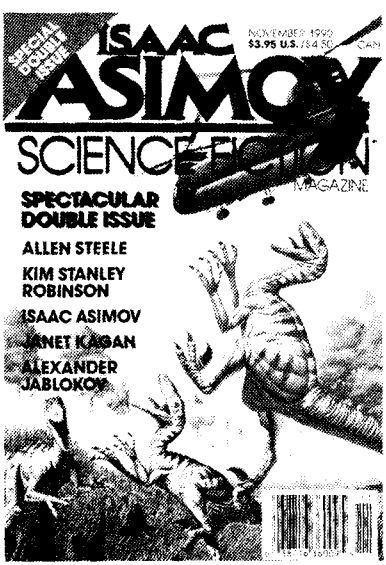

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are gone. You'll learn that slowly, and those of you who find yourself agreeing with us should find your own path into the wilds. Please don't come looking for us, though.

"But to those of you who stay here in the Prime Site, a word of warning. Do not forget who and what you are, no matter how much your lives change."

He reached into his pocket and pulled out a piece of paper.

"Here it is, Eddie. You wrote the resolution for me, so I'm returning the favor. Mr. Clerk, listen up carefully.

"I hereby move that we adopt the following resolution. Resolved: that the members of scout den Iroquois, who wish to continue the mission of the den and scout new territory for the colonists of Asgard, be allowed to form a new organization to be called den Pequot, and that it be further resolved that den Iroquois will retain title to the Main Post, the Highland Post, the Highland township and the Main Post township, while title to all remaining posts and townships currently settled be turned over to the new den.

"This is something that has to come sooner or later boys. Now you can blame it all on me."

Guy was overwhelmed. He looked down at the table and at the scoutmasters around it, lit by the flickering glow of the bonfires at the far ends of the stage. For a moment, he saw them as they really were. Grampa Bob was a scornful and bitter tyrant, telling everyone what to do, what was best for them. Eddie Gilmartin was impatient and ambitious, filled with a restlessness that would never be quenched. Lyle Sanderson was a passive, withdrawn man grown old before his time whose life had remained within the safe bounds of South Valley and whose future lay there, too.

They were all very ordinary, very human figures, he realized, all sharing feelings very much like his.

Grampa Bob passed the resolution down the table to the clerk and the great natural bowl full of scouts hung in tense silence until it reached the end.

"If this isn't what you want, now is the time to say so," the old scoutmaster said.

The president of the council, the scoutmaster from Albion, said: "There's a motion on the floor, do I hear a second?"

A few people shouted from the audience, then another scoutmaster from one of the outlying posts raised a hand. "Second," he mumbled.

"The motion has been made and seconded," said the president. "Is there discussion?"

"This isn't really the time or the place for this discussion," Lyle Sanderson said meekly.

"This is exactly the time and the place," Grampa Bob shot back. "Or would you rather wait until the colonists come around the Main Post putting price tags on the furniture and offering to rent you back the main lodge at a discount?"

"Why fight it, Lyle?" Eddie Gilmartin said. "You know he's right. And we can't face the colonists unless our house is in order. It's something we've both discussed. We can't try to go two directions at once and we can't both be the leader of den Iroquois. Separation isn't divorce, you know. We'll still come back to the Main Post and visit."

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"I thought you were the one who wanted to keep the den together."

"I did. Or I thought I did. Maybe I shouldn't get involved in politics like this. It's not my strongest trait. It just seems that things have changed tonight. And they're going to keep on changing. If we don't face this now, we're going to have to before the end of the year anyway. I move the question."

The council agreed to end the debate, the clerk read the resolution aloud and then went through the roll. There were no dissenting votes and the resolution was adopted.

Guy wanted to cry.

SEVEN

The bus ride from Highland Post to Asgard University the next day was long, dreary and depressing. Guy stayed on board when it stopped for a half hour at the Main Post. He couldn't look at it without feeling a terrible sense of loss.

He tried to nap, but images of the council meeting kept appearing in his dreams, only with grotesque caricatures of the participants holding forth.

Grampa Bob took on the look of a wild-eyed prophet with a robe and staff, straight out of the religious books. Eddie Gilmartin reverted to a primitive, Wild West cowboy character from an old video. And Lyle Sanderson became a long-haired guru from a spiritual disk. Surrounding the meeting was a crowd of hungry animals with their noses to the ground, snuffling loudly as they hunted their prey—the colonists. All that kept the beasts out was a tall barrier of twisted metal ribbon strung on sharp wooden stakes.

When the bus came over the last rise before the lake and he saw the wooden buildings spread out along the shore, his heart soared with joy. At least there was some place on Asgard that didn't make him feel bad. He could hardly wait to see Suzanne Baxter.

He laughed at that thought. It was probably the first time in his life that he wanted to see his girlfriend's mother more than his girlfriend. But he found Emily first, and her warm embrace soothed many of the open wounds that he had received the night before. Together, they went off to search for Suzanne. They found her in her lab, feeding the bits and bytes.

She stood at the cage for the byte named Giga, measuring out a precise meal in a plastic cup.

"So what's happening with Fuzzasaur Pass?" he asked with preamble. "Are they building the wall yet?"

Suzanne looked up and around, then returned to the task at hand, leaving Guy feeling a little disappointed and bewildered. He had been hoping for a more gracious welcome, although he should have known better than to expect that from Suzanne. "Yes, they're up there now," she said after a moment's silence.

She set the food tray in the cage, closed the top, and put the food and measuring cup on the lab table. Then she smiled at Guy.

"But if you're waiting for a hero's welcome, you'd better calm down," she said.

Guy felt his face grow hot.

That was the last thing he had been waiting for. But he had expected Suzanne to relieve some of the burden of

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guilt that he felt about ending the annual migration of fuzzasaurs. She did not.

"We were very lucky here in South Valley. The topography and the terrain have given us a unique opportunity. Your idea was right. If we block off the pass, then we deny access to the valley to the grazers." Emily squeezed his hand, and he smiled.

"But if I solved the grazer problem, why don't I feel a lot better about it?"

"Probably because you know it's not really a solution."

"No, it's not. It just creates a whole lot of other problems."

"That's right. Now that we're rid of the grazers, what do we do about the animals whose lives depend on them? The maxidons tend to follow the crowds, so there shouldn't be many in the valley this early in the year. But the rippers, the cavers, and the draggers all depend on a regular supply of grazer meat. You've taken away their food supply, Guy. What are we going to do about that? They're going to turn on the duckasaurs and the pineheads, the hivedrillers and the minisaurs. And they're going to go after the colonists' livestock—or even the colonists themselves. The maxidon may not like the way we smell, but the others aren't so picky.

"You've only reduced the number of animals we have to slaughter and shifted the target to other species. Now don't start trying to figure out another way around it, because there isn't one. We are alien invaders on this planet. We are imposing our ecology on it and we're kicking the indigenous one out. That means the animals, no matter how beautiful and graceful they are, must go. And it means we will end up killing a lot of them. There is no way around it."

"I never even thought of all that. I was upset because there wouldn't be any more grazers in South Valley. Now I feel even worse."

"This may have been one reason your Grampa Bob decided that there was no way to escape the evil that we brought to Asgard. As I understand it, there was a long debate on old Earth before the New Era about whether we had the moral right to colonize worlds like this in the first place—especially knowing that we would have to slaughter the grazers or the rippers or both before we were done."

She returned to the bag of byte food and looked down at her laptop before measuring out a small amount. Then she opened the top of the Mega's cage.

"And the other thing is that your solution only applies to South Valley. What are we going to do when colonists start to settle on the other side of the pass? Or when they move south of Albion? The grazers are everywhere. We can't just close a door on them forever."

"No, I guess we can't. That's why Grampa Bob was wrong, isn't it? He's trying to close a door on the world. But you can't really keep it out."

"Hey, Guy, cheer up. You've bought us time—twenty years of it. According to the settlement plan, it'll be that long before we reach our limits here at Prime Site. Maybe by then, we can figure out some way to live with the bluenecks and the redcrests and even the rippers and the maxidons."

"How are we going to do that? There won't be any around to practice on. And the way things look to me, we aren't

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going to be able to figure out how to live with one another, let alone the fuzzies. Everybody is building up walls and fences and running away. They're all trying to close doors on the world. . . ."

Then an idea struck him from that dark place where ideas lurk before they are known.

"Suzanne, do you think we could tell the stonemasons up in Fuzzasaur Pass to put a gate in that wall to let some of the grazers through—"

"—at a regulated rate until there were only as many as we wanted before we closed the gate. Oh Guy, for a scout, you're an awfully sophisticated young man. That's an excellent idea. I'll get on the phone right now. . . "

Emily threw her arms around Guy and planted a hungry kiss on his lips. He felt a warm glow rise from the soles of his feet and for the first time in days, he felt satisfied with himself.

But not for very long.

"Don't start to get too self-satisfied, Guy," Suzanne said. "That still doesn't solve everything. First of all, we've got to count the little fuzzies as they come through the gate. How would you like to spend a couple of weeks up there doing that?"

"Mother!" Emily squealed in protest. "He just got back."

"Well, maybe we can do that electronically. But I can think of one job he could help with. Someone's going to have to close the gate when we've let enough of them through. Someone big and strong—just like you. . . ."

Guy let the suggestion hang in the air as he returned Emily's kiss. ■

●Even considering the improvements possible . . . the gas turbine could hardly be considered a feasible application to airplanes because of the difficulty of complying with the stringent weight requirements. . . .

US National Academy of Science, 1940

●It may not be possible to build a vehicle with single-stage-to-orbit capability in the mid 1990s.

US National Academy of Science, 1989

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Dr. Gay E. Canough &
Dr. Lawrence P. Lehman

WHAT GOES AROUND, COMES AROUND: WHAT TO DO ABOUT SPACE DEBRIS?

We humans are such litterbugs! Whenever we move into a new space, we tend to assume that the space is without limits. Under this assumption, we throw our garbage everywhere. Today, many industrialized nations are coming face to face with this garbage problem. Landfills are full, and burning is often unacceptable. Many people think they can throw the garbage in the oceans, after all, oceans are so large, who is going to notice? But alas, garbage thrown in the ocean comes back to haunt the shores. Why do we tend to throw so much away? Part of it is economic shortsightedness. It is cheaper to throw it away today, never mind the cost to clean it up tomorrow. If recycling is not less expensive than dumping, people won't recycle. When it does become economical, recycling plants open.

So here we are on the threshold of another frontier. A very large space, so large we tend to forget its finiteness. It is near Earth space. Near Earth space we'll define as all the space around the Earth inside and including geosynchronous orbit. The volume of low Earth orbit alone is about half a trillion cubic kilometers. Do we have to worry about

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polluting such a large volume? Unfortunately, we already have polluted it. We now need to worry about how to clean it up! It has not been as difficult to pollute this large space as we thought. Figure 1 shows a snapshot of the 7,000 or so trackable objects in near Earth orbit.

NATURE OF SPACE DEBRIS

Sources

How did near Earth space get to be such a mess? Only 31 years ago, there was nothing man-made in orbit about the Earth. Spacecraft designers did not worry about encountering anything except meteoroids. But in the course of the last three decades, we have launched thousands of items into orbit. For example, the Soviets have maintained a steady launch rate of about 100 launches per year for at least the last 10 years. The US has maintained a rate of about 10 launches per year. Other countries got into the act in the '80s, including Europe, Japan, and China. The European company, Arianespace, now has more than half of the world's customers. These countries and others intend to develop their own space programs and have their own communications satellites.

Each time a satellite or other spacecraft is launched, there are items discarded from it that remain in orbit. These include payload fairings, used upper rocket stages and bolts that are blown off as part of pyrotechnic deployment of booms, antennae, or solar panels. When a spacecraft runs out of

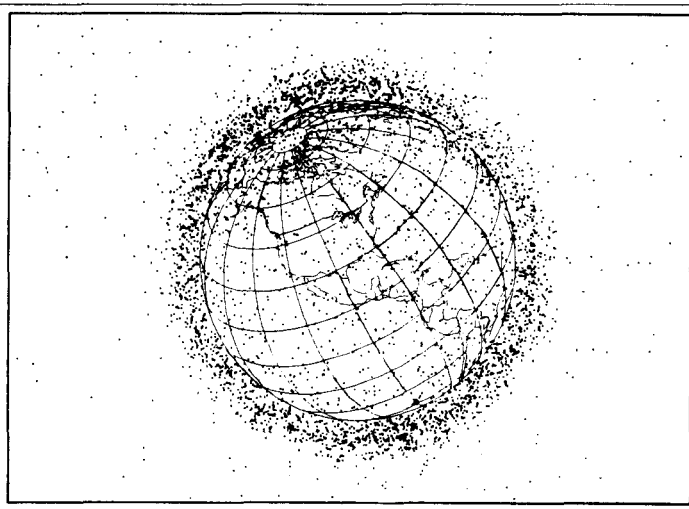

Figure 1: Snapshot of the near Earth environment as of May 1988. Courtesy of Nicholas L. Johnson, Teledyne Engineering.

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station keeping fuel, it is just another piece of junk. Some spacecraft are powered by nuclear reactors, and there are 1.5 tons worth of spent nuclear fuel in orbit. In addition, solid rocket motors have aluminum oxides in their exhaust and these particles may be a source of corrosion (by collisional pitting) to other spacecraft. Many spacecraft are painted and after they are in orbit for a time, the constant cycling in and out of the sun and exposure to atomic oxygen causes the paint to flake off. These paint flakes, traveling at 7 km/s (15,639 mi/hr) can cause significant damage. The most famous example of this was a space shuttle window (Challenger, 1983) which had to be replaced when a 4 mm pit was formed in it by collision with a 0.2 mm paint flake! This made the flight crew more than a little nervous.

To compound this already messy situation, Soviet anti-satellite tests, Strategic Defense Initiative (SDI) tests and used rocket explosions have added still more small pieces to the debris population. Some of the observed breakups of satellites have no known cause, raising the ugly possibility that a collision with other debris occurred. Tables 1 and 2 summarize the known sources of debris. The data are from 1987 and 1988 [3,19].

For deliberate breakups, 55% of the

TABLE 1: Known sources of fragmentary debris.

SOURCES	Rocket Exhaust	Chemical Reaction of Plasma with Satellite	Satellite Breakups
TYPES	Aluminum Particles	Paint chips	Fragments
SIZES	Microns to Millimeters	Microns to Millimeters	Microns to Meters

TABLE 2: Satellite Breakups.

CAUSES	Deliberate	Propulsion Related	Unknown
EVENTS	34	13	39
NUMBER & SOURCE OF OBJECTS	409 Soviet ASAT	835 Delta 2nd Stages	? Collisions
	328 Other	110 Non-Delta	? Non-Impact
TOTAL	737	945	1141
PERCENT	26%	34%	40%

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debris still in orbit can be accounted for by Soviet ASAT tests. Our own SDI programs have created little debris, but future tests of so-called brilliant pebbles may create much more if not conducted carefully. The inventors of this concept propose to launch several thousand small, smart spacecraft to be used to destroy enemy missiles in flight if war breaks out. These spacecraft, dubbed brilliant pebbles, are about one meter in size and could kill a missile by disrupting its guidance and control systems. While the idea of lasers and particle beams to destroy missiles has had a lot of media attention, the fact is that the most practical way to kill a missile is with simple projectiles (bullets). A brilliant pebble might accomplish this by either shooting a bullet or crashing itself into the missile. As you might suspect, this would cause an unprecedented amount of space debris! There are other problems, even during peacetime. Several thousand new small spacecraft would be a hazard by themselves, although their orbits would be known. There is also some fear that one of the pebbles would not be as smart as it's supposed to be and might shoot down a working spacecraft. Then there is the question of what to do with a brilliant pebble spacecraft when it is out of station-keeping fuel or has some breakdown.

Some notable debris-creating events include an Ariane rocket which blew up in 1986 and added 200 pieces of debris, strewn from 430 km to 1350 km; Cosmos 1275 is suspected to have collided with other debris. It is said that the particularly messy fragmentation of just 10 satellites accounts for ⅓ of all trackable debris [3].

JUST HOW MUCH JUNK IS UP THERE

There are over 7,000 trackable items, most in the popular low orbits (200 to 700 km). These objects are all carefully tracked (using radar) and cataloged by the US NORAD (North American Air Defense). NORAD needs to keep track of items in orbit in order to distinguish junk from incoming enemy missiles [19]. Unfortunately, there is so much junk for them to track, that they are working near the capacity of their systems. This means that distinguishing missiles from junk is all the more difficult. (A scary thought: what if they make a mistake?)

Of these 7,000 or so items, only 5% of them are working spacecraft. The smallest trackable item at 500 km is 10 cm, and at geosynchronous orbit (35785 km), the smallest trackable object is 1 meter. Notice the key word *trackable*. The question that comes to mind immediately is, what about the debris we cannot track using radar? MIT scientists set out to get some idea of the population of smaller objects in orbit. Using telescopes, they could see about 8 times the number of objects tracked by radar, implying over 50,000 objects larger than 1 cm [4].

This still does not seem like large enough amount of junk to pollute a half a trillion cubic kilometers. But consider, this situation is not at all like leaving a bunch of junk cars scattered out over

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somebody's large estate. In space, debris does not stay put. In fact the orbital location of a debris object cannot be predicted for longer than a couple of weeks. After a few months, the object may be found with equal probability anywhere within a volume bounded by its apogee, its perigee, and the north and south latitude lines equal to its inclination. Suppose an object has an apogee of 550 km, a perigee of 450 km and an inclination of 25 degrees, then it occupies a volume of 22 billion cubic kilometers or 4.5% of the volume of low Earth orbit! What you discard here, today, will be on the other side of the Earth in about 45 minutes. And after a few months, due to orbital perturbations, that piece of debris may greet you with a hypervelocity reminder of your carelessness, thus proving the maxim that "what goes around comes around." Taking all these things into account, collision probabilities have been calculated for different size spacecraft and from these calculations comes the probabilities of collision for the Hubble Space Telescope and the Freedom Space station as shown below.

WHY HYPERVELOCITY COLLISIONS ARE NO FUN

What is a *hypervelocity* collision? A collision is termed "hypervelocity" when the stresses generated by the collision significantly exceed the ultimate material strength of both the target and the projectile. The exact threshold for a collision to be termed hypervelocity depends upon the particular materials. For most practical materials, e.g., aluminum, relative collision velocities greater than 3 km/s are well within the hypervelocity regime [28].

A hypervelocity collision of a working spacecraft with a 10 cm (1.4 kg for aluminum) piece of space debris will completely demolish the craft. This is a real concern especially to astronauts, but also to operators of $100 million satellites. The collisions are so destructive because items in orbit are moving at speeds of 7 km/s (or 15639 mi/hr) and average collisional velocities are around 10 km/s. If you could drive 7 km/s it would take you about 10 minutes to go from New York to San Francisco! To give you an idea of what this means in terms of destructive energy, consider the fact that an 80 gram piece (3.8 cm, aluminum) of debris striking a satellite at 10 km/s has the same energy as 1 kg of TNT. 1 kg of TNT will produce about 4,000,000 Joules (4000 Joules/gram) of explosive energy, enough to "propel an economy-sized car 300 meters into the air." [14] Calculate the kinetic energy, using the formula,

$$KE = \tfrac{1}{2}\, mv^2$$

for various size objects and you will see that, "a collision in orbit could really ruin your day" [23].

THE PROBABILITY OF COLLISION

Scientists at NASA Johnson space center have made a career of trying to calculate the probability of collision with space debris. The design of the Freedom space station depends upon these estimates, since it is a large structure. The larger the structure, the higher the probability of a hit. Estimates range

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from 1% to 10% probability that Freedom will suffer major damage sometime during its 10-year life due to collision with space debris. For the Hubble space telescope, there is about a 1% chance (over its 17-year life) that it will be severely damaged by a collision with debris [24]. Figure 2 shows probabilities of collision for different sized structures. Because of the large uncertainty of the debris population, these calculations necessarily have rather large errors. Nevertheless, the worry of collision is great enough that space station designers are now considering installing "debris bumpers" on all the modules. These bumpers serve to break up a large piece of debris into many smaller ones, which then are not as likely to penetrate the station's hull. Such measures increase the cost of the station and decrease the internal dimensions of the modules, assuming the bumpers are an integral part of each module and that each module must fit into the shuttle payload bay.

Designers working on station solar power systems are working on how to protect the solar panels from corrosion due to collision with microscopic bits of debris.

THE THREAT OF DEBRIS GROWTH BY COLLISIONS

There is another problem looming ominously on the horizon. This is the possibility that the debris population will grow so large that collisions will begin to produce more pieces at an ever increasing rate. If this happens, cessation of all space activities will not insure the growth will stop! We could end up stuck on Earth for 100 years waiting for the debris cloud to dissipate. More than

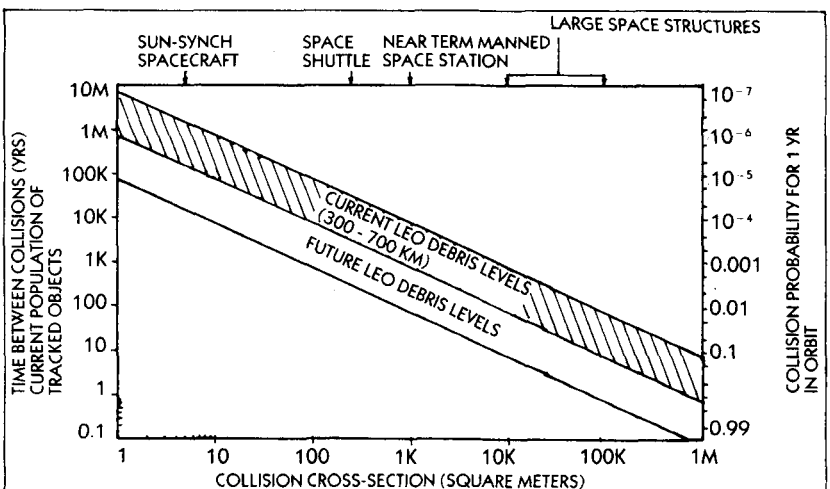

Figure 2: Collision hazards from space debris for different size structures. Courtesy Norm Fischer, Batelle Labs.

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one science fiction story has dealt with this scenario and F. Pohl has pointed out that a debris cloud might also be produced by use of SDI weapons to stop missiles.

CLEAN UP THE MESS . . . START TODAY!

Prevention

For low orbits, drag from the atmosphere helps to clean up debris. A satellite in a 200 km orbit will be dragged down in just 2 days. The Sun can further aid this process by fluffing the atmosphere up to higher than normal altitudes during peak solar activity.

Natural forces are not enough to solve our problems, though. Some actions being taken today include prevention and putting dead satellites into special parking orbits.

Some measures currently being taken include: 1) Insuring that payload fairings and used rockets fall back to Earth quickly. 2) Leaving the apogee kick motor attached to its communication satellite so it does not pass through the geostationary orbit (GEO). 3) Doing a depletion burn in rocket stages that do not fall back quickly, to assure the leftover fuel will not cause an explosion later. 4) International agreements now being sought are designed to get all spacefaring nations to limit creation of debris. 5) Communications satellites are often parked in a higher orbit (outside GEO) at the end of their life.

Collisions in GEO are a special worry since any debris created will remain in the ring for thousands of years.

While the prevention of debris is a worthy goal, it will not solve all our troubles. People are always creating garbage. Most people studying debris see the current population as a relatively low hazard (in spite of some of the dire warnings and collision probabilities). In truth, the overall hazard today is not something that should keep you up nights worrying. However, as space activity grows so will debris.

In the past, when cleanup of debris by a robotic garbage truck or debris sweeper has been proposed, experts say that it is just too expensive and difficult to do such a thing. It will indeed be expensive. However, we must begin today to develop technology to remove debris. Without such technology available, the problem might get out of hand before we can do anything about it. For example, suppose that after the Freedom space station is in operation for five years, it is threatened by collision with something large every 90 minutes. Its only recourse would be to expend fuel on avoidance maneuvers. Having some sort of device on hand to remove the threatening debris would be very handy. Then, as technology improves, we can evolve the collection and disposal of debris into a salvage business. After all, anything in orbit is at least $3,000 per pound more valuable up there than it would be down here simply because of launch costs.

What technologies that exist now could be used in the design of a space garbage truck or debris sweeper? The main problem of collecting is that propulsion from one orbit to another is energy intensive and hence expensive. We

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now address some possible solutions for different categories of debris.

The debris population can be categorized by size and orbit. Trackable objects are 10 cm or larger. These items could be rendezvoused with for collection or de-orbit. The 1 to 10 cm range might be dealt with via a "debris sweeper" as discussed below. Very small objects of less than 1 cm in size are probably too difficult to deal with, but the removal of the larger pieces will remove the source for the smaller ones.

Removal of larger objects

Starting with the larger objects, consider what cleanup options might be used for different orbits. Of course, we can adopt the traditional solution and use chemical propulsion to rendezvous with an object and then lower its orbit. But let's see if there are any more economical ways to do the same job. After all, there are natural forces at work which we can exploit.

Below 700 km, the natural force of drag (by the tenuous atmosphere) means that space stations and satellites must expend fuel to stay in orbit. Usually we think of drag as a "problem" which makes our spacecraft more expensive because more fuel has to be carried along. On the positive side, drag is one way that debris is removed naturally from low orbit. We could exploit this force by attaching a drag device (such a large balloon) to a large piece of debris. Although we might ultimately consider salvaging debris, the simplest and cheapest thing to do first is to just get it out of the way by lowering its orbit so that it will burn up in the Earth's atmosphere in a relatively short time.

We did a calculation to find out how

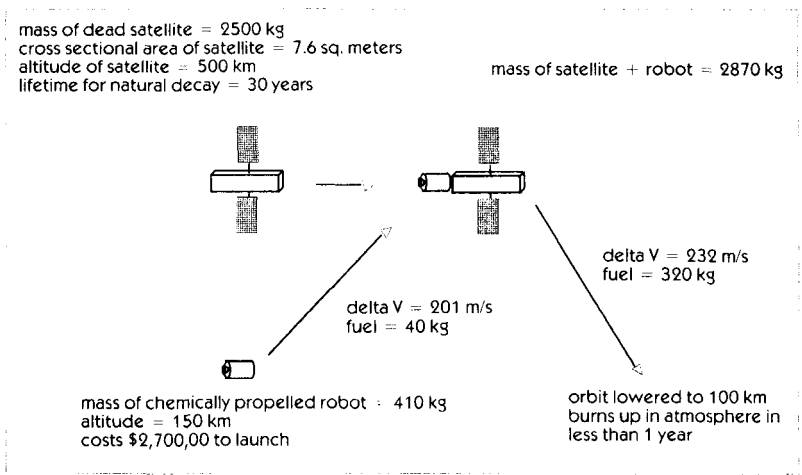
mass of dead satellite = 2500 kg
cross sectional area of satellite = 7.6 sq. meters
altitude of satellite = 500 km
lifetime for natural decay = 30 years
mass of satellite + robot = 2870 kg
delta V = 232 m/s
fuel = 320 kg
delta V = 201 m/s
fuel = 40 kg
mass of chemically propelled robot = 410 kg
altitude = 150 km
costs $2,700,00 to launch
orbit lowered to 100 km
burns up in atmosphere in
less than 1 year

Figure 3a: Chemically propelled robot device for removal of space debris. See text for more details.

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using a drag device would compare to using chemical propulsion to lower the orbit of a piece of debris. Figure 3a shows a 2,500 kg dead satellite being retrieved by an all chemically propelled garbage truck. The truck rendezvous with and attaches itself to the satellite. It then must expend fuel to lower the orbit of itself plus the satellite. To lower the orbit from 500 km to 100 km (thus reducing the lifetime of the satellite from 30 years to less than 1 year) would require a change in velocity (delta V) of 232 m/s. For a hydrazine-fueled rocket, this translates into 320 kg of fuel.

We now compare this to the drag device solution shown in Figure 3b. In this scenario, the garbage truck attaches to the satellite and deploys a large balloon as the drag device. The balloon increases the area of the satellite from 7.6 m^2 to 314 m^2. The larger surface area significantly increases the drag on the satellite, and the lifetime is reduced from 30 years to less than 1 year. We assumed the mass of the garbage truck spacecraft bus to be 50 kg for both the chemically propelled and drag systems. The mass of a 1 mil thick mylar balloon is about 40 kg, whereas the fuel needed to lower the orbit chemically is 320 kg.

Clearly, the drag system is lighter weight and this translates into significant cost savings for launching it. Dragging down debris could be done for any object small enough to burn up completely in Earth's atmosphere [25].

Another natural force that could be used below 700 km is the magnetism of the Earth. The Earth's magnetic field and the strong gravity gradient present in near Earth space offers a synergistic combination for electromagnetic tether vehicles. A tether vehicle consists of two spacecraft units connected by one

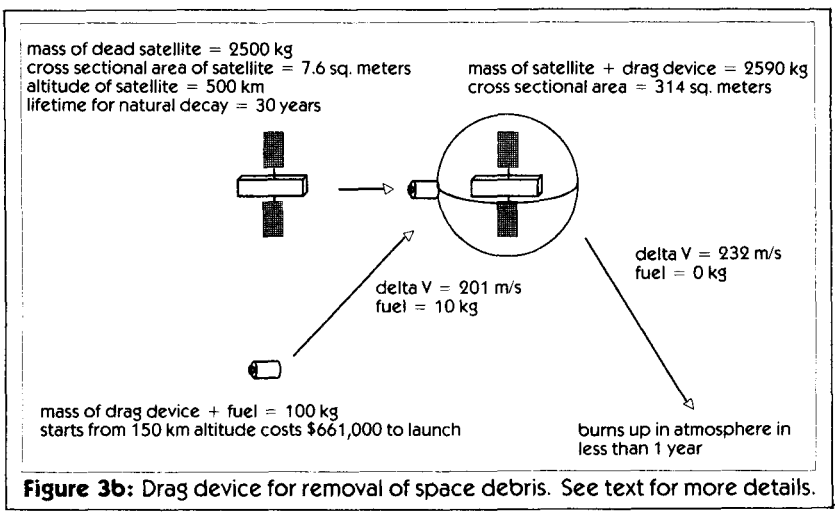
mass of dead satellite = 2500 kg
cross sectional area of satellite = 7.6 sq. meters
altitude of satellite = 500 km
lifetime for natural decay = 30 years
mass of satellite + drag device = 2590 kg
cross sectional area = 314 sq. meters
delta V = 232 m/s
fuel = 0 kg
delta V = 201 m/s
fuel = 10 kg
mass of drag device + fuel = 100 kg
starts from 150 km altitude costs $661,000 to launch
burns up in atmosphere in
less than 1 year

Figure 3b: Drag device for removal of space debris. See text for more details.

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or more tethers. Typically the tethers will be 10 to 100 km in length. An electromagnetic tether vehicle operates with the spacecraft units oriented so that the tethers are stretched tight along a "vertical line," (a line radiating from the center of the Earth). The gravity gradient of the Earth tends to cause the two spacecraft units to move apart along the vertical line, and thus keep the tethers tight and vertically oriented. As the tether craft orbits the Earth along an equatorial orbit, the tethers cut through the magnetic lines of force which connect the North and South geomagnetic poles of the Earth. The tethers are made of some electrically conducting material. From basic electrodynamics we know that a wire moving through a magnetic field with a certain velocity will have an emf induced in it. (Faraday's Law and Lenz's Law: If you have ever had a small shock from your bicycle gear cable while riding under an electric power line, you have experienced Faraday's law first hand!) The plasma in space completes the electric circuit by providing a second conducting path from one end of the tether to the other. The ends of the tether must make good electrical contact with the surrounding plasma for current (I) to flow. If the current flows up the tether, it acts as a generator. If current flows down the tether (by using a power supply to buck the induced emf) the tether acts as a thruster. The direction of current flow is determined by the velocity (east), the magnetic field, **B**, (points north) and the right-hand rule for the vector cross product $\mathbf{E} = \mathbf{v} \times \mathbf{B}$ (**E** is the electric field). The tether tends to accelerate or decelerate along its orbital path, due to the Lorentz force ($I\mathbf{l} \times \mathbf{B}$, where $\mathbf{l}$ = length of the tether) on it. These craft can operate effectively between the altitudes of 150 km and 500 km in a generally equatorial orbit. This is roughly the same as the drag regime because the electromagnetic tether requires a substantial plasma density to complete its electrical circuit [10].

These craft might be used to gather large masses of debris and exploit that mass to give orbital transfer boosts to other satellites (a kind of "crack the whip" approach to orbital transfer). In the simplest scenario possible, debris collection might be implemented by overtaking the debris at a small relative velocity and capturing it in a netlike device.

One of the big drawbacks to this type of debris collector is that the tethers themselves present a large area that could be hit by small pieces of debris, thus cutting them.

At higher altitudes (700 km and up), solar-powered ion engines or solar sails might be employed [18]. These devices could slowly raise the orbits of larger pieces of junk and so get them out of the way. We might even send particularly nasty items, such as used nuclear reactors, completely out of Earth space. Just think of them as nice little souvenirs for future interplanetary travellers. ("Yes, captain, it looks like this one originates from the same planet as the last one . . . those humans sure are messy. Why, their entire system is littered with debris!") Well, OK, we

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could send junk on a trajectory into the Sun.

GARBAGE WARS—REMOVAL OF SMALLER OBJECTS

Now what about the 1 to 10 cm-sized objects in low orbits? To remove these, we need a debris sweeper. There are many thousands of these objects and so sweeping is the only way to efficiently get rid of them. For this task we could exploit the natural force of "military spending." Work is going on now under the Strategic Defense Initiative (SDI) on the use of "laser-induced ablation momentum transfer to guide a hypervelocity spherical projectile to a target [26]." More simply put, this is the use of lasers to heat a small object (1 to 5 cm in size) and cause it to be propelled by the expulsion of material from its surface (due to heating by the laser). The material comes out in one direction and the object moves in the opposite direction. (This is quite different from the notion of laser propulsion by the pressure of the light.) This technique of propulsion through ablation could be employed to change the velocity of small debris particles enough so that they would be dragged down more quickly. Because a laser could be pointed and fired rapidly, we could hope to clean up large volumes of space in a reasonable time. To see if this type of system is practical, several questions need to be answered:

* Objects in low orbit are traveling at velocities of 7 km/s. How much change in velocity is needed to significantly lower the orbit of a 1 cm particle?
* What type of laser beam is the most efficient?
* What range does the laser need to have?
* How often could the laser fire?
* How much power is needed to run the laser and change the orbit of the platform?

A study done at Los Alamos (for SDI) explored these and other questions. They discovered, through modeling and experimentation, that:

* Momentum transfer is maximized when there is little vaporization or melting of the surface of the target and mostly cold material is ejected.
* High energy, short duration (a few nanoseconds) pulses are more efficient than long pulses.
* Short wavelength (a quarter micron) lasers give a higher impulse, possibly due to more absorption in the target.
* The size of the beam spot at the target should be such that most of the beam is perpendicular to as much of the surface of the target as possible. For example, the optimum spot size for a 0.5 kiloJoule pulse on a 0.5 cm target is half the size of the target. As the energy of the laser pulse increases, so can the spot size, until the size of the spot exceeds that of the

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target and then some of the energy goes to waste.

Velocity changes (Delta V) of a few meters per second can be achieved with laser pulses of a few kiloJoules. A 0.5 kJ pulse gives a delta V of 2 m/s. A 10 kJ pulse gives a delta V of about 30 m/s, for 0.5 cm particles of mass 0.027 gm. This calculation was carried out for several different sizes and masses.

Knowing the delta V, the next question is, how much does this change the orbit of a debris particle? The effect of the change in delta V is to lower the perigee (closest approach to Earth). This can be calculated using the relationship between velocity and radius for an orbit [20]. The results for a delta V of 30 m/s is a change in perigee by 120 km. If the original particle was in a fairly low orbit to start with (say 300 km), its lifetime will be reduced to hours.

A system proposed to do the job is a KrF laser with a range of around 10 km. It would be mounted on an orbiting platform. An electric propulsion system could be used to move the platform from one orbit to another. The 10 kJ laser and electric propulsion system would require around 100 kW of power. To make the platform compact, a nuclear power system such as the SP 100 would be a good choice. The total mass of this debris sweeper would be around 6 tons. If the laser fired just once per hour and remained active for 5 years, it could take out over 40,000 smaller objects. This number rivals some of the current estimates of the 1 to 10 cm population. Figure 4 shows a conceptual drawing of such a system. One of the problems in commanding and tracking a sophisticated spacecraft in low orbit is that tracking has to be handed off from one ground station to the next around the globe. This job is now simplified by the

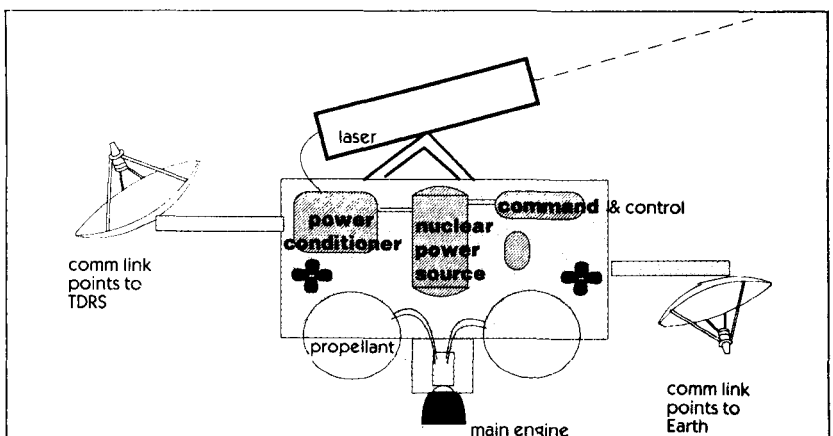

Figure 4: Sweeping space debris with high power laser.

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NASA TDRS (Tracking Data Relay Satellite) system. The TDRSs are in geostationary orbit and a spacecraft in low orbit can be communicated with through them. Figure 4 shows a spacecraft with 2 antennae, one that points to TDRS and a backup that points to Earth. In fact, this spacecraft would need many redundant systems and safety features, since an out-of-control high power laser in orbit would be totally uncouth!

This system might seem a bit grandiose, but if something similar is already in the works for SDI, we can just adapt it to debris sweeping. Imagine how horrified the generals will be to find that their marvelous space weapons system is nothing but a garbage scourer!

* * *

SUMMARY

We Terrans really need to clean up our mess before it gets out of control. There are several approaches to doing this, but in general we should start with simple schemes that can be implemented in the next 5 years and work our way up to the more complex debris removal devices. We have this bad habit of waiting until a problem becomes a crisis before doing anything about it. In space, a crisis could mean loss of life and destruction of very expensive space stations or other structures.

As they say in the garbage business, "It's a dirty job, but somebody has to do it." ■

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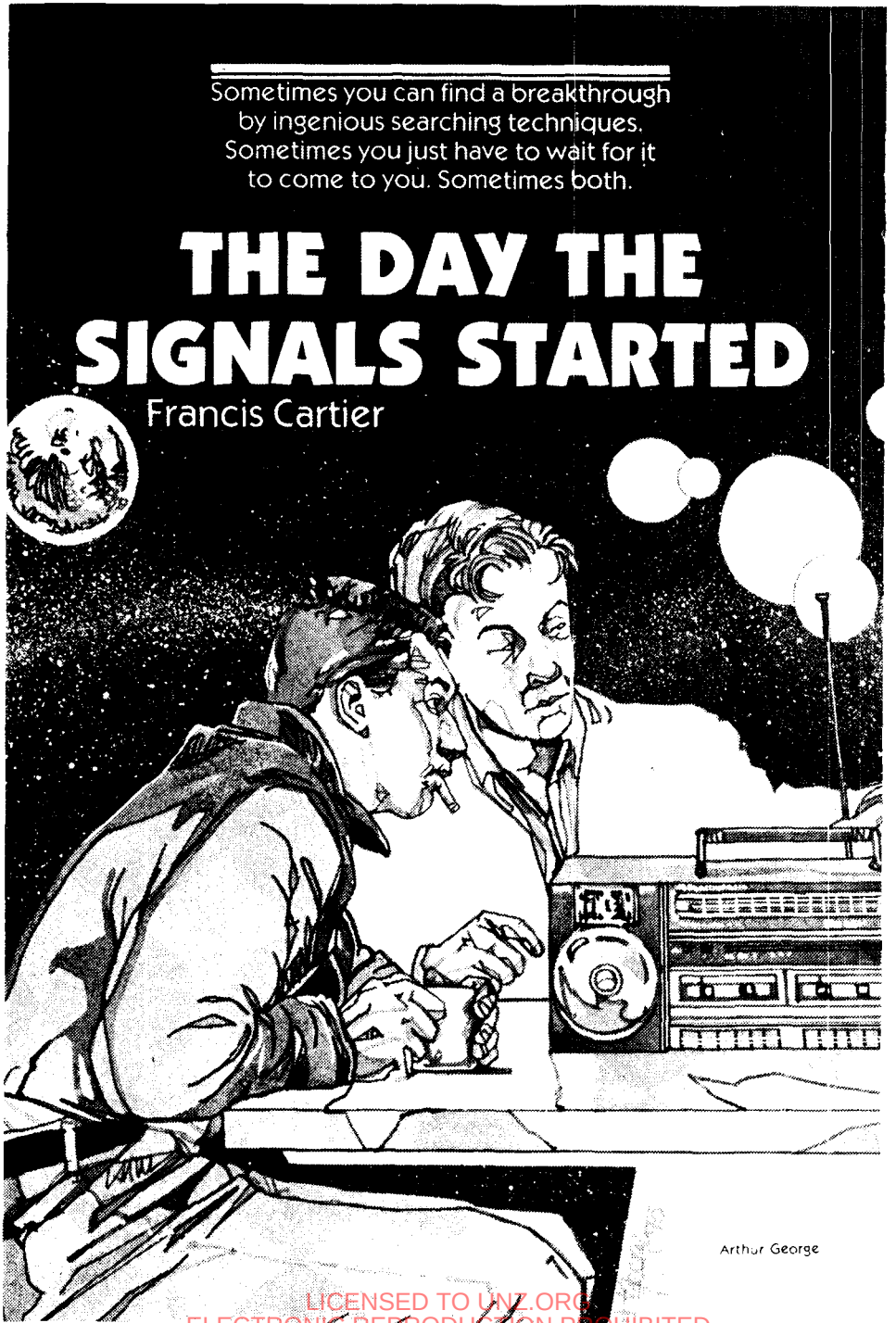
Sometimes you can find a breakthrough by ingenious searching techniques. Sometimes you just have to wait for it to come to you. Sometimes both.

THE DAY THE SIGNALS STARTED

Francis Cartier



Arthur George

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September 3, 1991

"The logic of it was good, but not good enough," Harlingen Pierce said, looking around the conference table. "We figured that any extraterrestrial civilization that would be trying to send signals out would be at least as advanced as we are, probably more, and so They . . ." he pronounced it as though it began with a capital letter, "They, like us, would find the so-called 'waterhole' frequency of around 1550 MHz to be most attractive."

"Yes, of course," Miss Harris said, mostly for the benefit of Dr. Melissa Boyle, the new member of the Star Bowl team, "because there is the least thermal noise there. What's wrong with that?"

"What's wrong?! What's wrong," Pierce said with quite obvious impatience, "is that we've—" He broke off as he noticed the scowl on Dr. Ward's face. Raymond Ward, the chief of Project Star Bowl, had been patiently searching for a signal from an extra-terrestrial intelligence for about thirty-five years. Pierce was well aware that his seventy-three-year-old boss encouraged cold, methodical differences of opinions but was not particularly tolerant of heated arguments.

"Go ahead," said Dr. Ward, "But calmly, please." He also glanced expressionlessly at Miss Harris. It was a look she knew well after all these years. It meant, "Don't interrupt; we could lose an idea that way." She nodded, though she thought Pierce was sounding intolerably superior.

Pierce continued, this time in carefully measured word and tone, though still with an edge to his voice that he didn't try to hide. "What's wrong is that not every one of us thinks that way. Let's suppose for a moment that They are at almost exactly our state of technological development—maybe just a little ahead in the wattage They can put out. Now what kind of logic are They going to use in choosing a signal to send out into space?" He paused, but it was clearly a rhetorical question, so the other three around the table waited for him to continue. "OK, then, They've got broadcast radio and television. They use them for common mass communication. A lot of us have radios and TVs so a lot of Them have, too. These are not just laboratory devices that operate at weird frequencies like 1550 MHz. They are common household appliances."

"So are you suggesting, Harley," said Melissa, "that They might choose to use common TV bands or even AM radio frequencies like 540 to 1600 KHz?"

"Exactly," said Pierce. "We settled on our AM broadcast frequencies for some good reasons. Why wouldn't They make the same choice for the same reasons? Look. If I were Them, I'd want to make sure that there were enough potential receivers to get my signal, wouldn't I? At our state of technology, we have damned few receivers working all the time in the megahertz range. On the other hand, we have millions of receivers turned on all the time down in the kilohertz range."

"Wait though," interjected Miss Harris. "Wouldn't They need a lot more wattage in that band?" She turned to Dr. Ward for confirmation.

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Ward had leaned back in his chair and was tapping his empty pipe on his teeth. He never smoked in the conference room any more, but the old briar pipe was an immutable fixture of his personality. He used it as a pointer, a gavel, a gesture-magnifier, and now as a prod to his thinking. "Yes," he finally said, "But Harley has hypothesized that They might be somewhat ahead of us in output power."

"Sure, maybe a little. Why not?" Pierce said, as though he expected a challenge. He looked around the table with his chin held high as if waiting for someone to take a poke at it. "What I'm saying is that their technology is probably very, very close to ours, not necessarily identical."

The others were looking at Ward. It was decision time. Would he reject the idea? Would he suggest that Harley Pierce refine it and resubmit it with additional, stronger arguments? Might he appoint a committee?

Ward tapped the pipe on his teeth. He scowled briefly. He ran a hand through his hair—hair that had turned pure white in his thirty-five years with the Star Bowl listening project. Except for his service as a cryptologist during World War II, he had spent nearly his whole professional career in the maddeningly frustrating business of searching for meaningful signals from the Universe. More than once his patience had nearly run out and he seriously considered leaving the search to the big guys at Oak Ridge and Buenos Aires with their 8.4 million channel META receiver-analyser. But Star Bowl Foundation's erratic private funding somehow continued and he'd stuck with it.

He looked around the conference table. Miss Harris was frowning, feeling and sharing his difficulty with the decision. Melissa Boyle's expression was merely quizzical.

Pierce had caught himself drumming his fingers on the table and stopped abruptly, his mouth pursed in exasperation.

Finally, the left corner of Ward's mouth curled up in a half smile. Miss Harris, after her nearly thirty years with him on the project, had learned that this presaged a decision. "OK," he said, very slowly, "we'll try listening on the broadcast band for three years. Three years is all our budget will support. "But . . ."

Pierce had almost begun to smile before that "but." Now he merely held his breath.

Ward turned to the newly-doctored and newly-hired Melissa Boyle. "Melissa, can you guess what the 'but' is about?"

Melissa recognized the seminar technique. Others had told her that Raymond Ward taught that way and managed that way.

Do I have to be right, she wondered, or just reasonably astute? Well, I need more time so I'll use my own seminar strategy. "I can think of several 'buts,' " she said. That opening gave her time to think while talking. "The first might be 'But how long on how many frequencies within the band can we afford?' Another might be, 'But if we don't find anything in three years, you're fired.' " They all laughed at that, Dr. Ward loudest of all. And then, during the laughter, it hit her what Ward wanted her to say. "But what are we going to listen for that

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everyone else on Earth might have been hearing all along and not recognizing as an ET signal?''

Ward smiled and pointed his pipe at her. ''Indeed,'' he said. ''Harley?''

Harlingen Pierce wondered if he should make his answer sound as though he were thinking on his feet; that might impress Miss Harris, the old bat. Or should he show that he had spent a lot of time working it out? That would impress Ward more. He decided it was Ward he wanted to impress. ''Well, of course I've thought a lot about that.'' He reached down, took some papers from his briefcase and placed them before him on the table, but didn't bother to look at them.

''First of all,'' he said in what he hoped was a dramatically over-controlled voice, ''none of the regular listeners to radio broadcasts has been expecting an extraterrestrial message so if they heard one they probably wouldn't suspect it was anything but static or interference. Right?'' Ward and Melissa nodded. Miss Harris sat impassively. ''So the signal might be any non-natural modulation of a carrier frequency in the range 500 to 1,500 kilohertz. We already have our computers hooked up to the Star Bowl antenna, set to sound an alarm and start the recorders working the moment they detect anything regular or patterned. We'll just stick with that set-up and see what we get.''

''And no one ever really listens to anything at all between the regular broadcast stations,'' added Melissa thoughtfully. She was just catching up with the argument and unaware of any tension between Pierce and Miss Harris.

''True,'' said Pierce, thankful of the help from the newcomer, ''and most people keep their AM radios tuned to only one, strong station, which would drown out any ET signal they'd hear anyway.''

''Hold on,'' said Miss Harris, leaning forward across the table toward Pierce. ''That's as it may be, but the question now is what we at Star Bowl are going to listen for. Let's get back to the immediate topic, shall we?''

''I know what we ought to be looking for,'' said Pierce. ''It's obvious.'' Both Ward's and Miss Harris's eyebrows shot up.

''Yes?'' asked Ward more calmly than Miss Harris expected. She knew how wary Ward was about the word *obvious*, ''The word,'' she'd often heard him say, ''that people use when they have no intention of examining the subject carefully.''

Pierce knew from their expressions that he'd done something wrong but didn't take the time to puzzle it out. ''Yes,'' he went on. ''Assuming that They think like us and are at about the same level of technology, it will be binary arithmetic, at least at first to get our attention. It has to be binary. They can't know whether we use an octal, decimal, duodecimal or whatever arithmetic. But They will know that arithmetic is essential to technology. They'll choose the simplest form.''

''Oh oh!'' said Melissa. ''Will our pattern-recognition programs trigger on an on-off signal in binary? Is that going to seem like a pattern to the program? Just how are They going to send pulses representing a simple count in binary that we can recognize?''

Pierce had no answer at first. Was

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Melissa that naive, or was there something in her question that he didn't see?

To stall, he shuffled through the papers in front of him as though he had the answer there. His mind was racing. Miss Harris saw his discomfort and leaned back in satisfaction. Surely he knows the answer, she thought, so why is he killing time?

It was Ward who broke the charged silence. "No problem, Melissa. If you draw a diagram of the binary digits just up to seven, you'll see that a pattern emerges. But you seem stuck with the idea of on-off as a representation of binary digits. There's a far better and clearer way; send plus-minus."

Melissa slapped her forehead. "Sorry. Dumb. A square wave is perfect for sending binary data."

Pierce shuffled his papers into a neat stack and placed his hand on it. "Of course," he said smugly.

Ward knocked his pipe on the table twice. "All right, then," he said, rising from his chair, "three years listening for binary digits in the broadcast band."

The same day: September 3, 1991, Earth calendar

"So the one event that every atom and therefore every living thing in the Universe has in common," said T3sh, "is the Big Bang." Actually he didn't say it, but typed it out and entered it into his console. The conference of Zzymbur experts on the search for extra-Zzymburian intelligence was being conducted on the institute's computer network. T3sh waited for his screen to show a reply from one of the other three participants.

It came from Chairman M3zzok. "You're saying, then, that any intelligent beings out there have had precisely the same amount of time to arise and develop that we have?"

"Precisely," T3sh entered. "And are therefore likely to be at just about our level of technology right now."

"Sorry," came the entry from Avn3, "but I can't agree with such a flagrantly illogical premise. You take no account of the myriad galactic accidents that led to the formation of our star, our planetary system, the chance conditions that led to the possibility of carbon-based life here on Planet Zzymbur, and all the random occurrences that led up to those things and the development of intelligence."

T3sh flinched as he read that input and felt sorry for Avn3. T3sh knew how Chairman M3zzok hated the word *random*. How many times had he heard and read M3zzok's statement that *random* was a word that people too often used when we were merely ignorant of the causes? "Randomness cannot by itself be a cause," he would say, "any more than time alone can be a cause." One of the disadvantages of network conferences that T3sh didn't like was that he couldn't read the expressions on other conferees' faces. He would have liked to see M3zzok's right now and fully expected the next message would be from him. T3sh felt he knew what it would be. He was wrong.

The next input was from the fourth conferee, Q3n1a. "We have always assumed that our message should be targeted on a planet something like Zzymbur, have we not? We assume that the beings who could read our message would be at least as advanced as our-

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selves. In fact, we often assume They will be vastly more advanced — demonstrating a kind of planetary inferiority complex that I have never fully understood. In any case, we have always had a problem with that assumption that They are far more advanced than ourselves. The problem is that we are unable to predict what those advances might be. I don't have to agree with T3sh's argument about having equal time from the Big Bang and therefore equal development. I can still agree with his premise that a receiving civilization would have to be quite like ours."

Chairman M3zzok entered next. "Yes, Q3n1a. It is not an untenable hypothesis that the receiving intelligences would have to be very much like us. In fact, we have no evidence to suppose otherwise, and no way to determine the most appropriate signals to send to civilizations that we cannot imagine."

"With all due respect, Chairman M3zzok," Avn3 entered, "Our science fiction writers have imagined thousands of them."

"True," entered T3sh, "but your point is academic at best. We have only recently gained access to sufficient power through life-temperature super-conductivity to make it feasible to send strong signals out into the Universe. We can send one kind of signal, but not thousands."

Chairman M3zzok entered immediately. "T3sh is right. The budget given us will permit only one kind of signal. We must decide only two things: how it will be transmitted and what the signal will be. Let us agree to return now to the specific agenda I sent to you earlier. First, we must decide on the signal. Once we have agreed on that, we can turn our attention to the best way of sending it. Do you concur?"

The other three conferees all sent ALT 5, indicating concurrence.

"Permit me," entered Avn3. "Our astronomers determined some forty years or so ago that the least cluttered electromagnetic frequency in the Universe is around 1,550,000,000 cycles. That is therefore the frequency we should use."

T3sh had anticipated that suggestion and hoped he could persuade the conferees otherwise. He was relieved to see that only Q3n1a entered ALT 5. T3sh quickly entered: "I believe there is a better alternative. If we assume that any potential receiver of our signal is at about the same technological level as ourselves, we must also assume that only a few of the most sophisticated of their astronomers are exploring such frequencies as 1,550 million cycles. There will, then, be few receivers operating at that frequency. But if we look at our own present situation, we see that mass use is being made of the frequencies from 300,000 to 1,500,000 cycles. The shorter of these waves is a trifle more efficient, so I suggest something around 1,200,000 cycles with a band width of, say, 300,000 cycles."

Chairman M3zzok entered. "We would have to determine the bandwidth depending on our power budget. My guess is that it would have to be much narrower than that. That is, if—I say if—we go along with T3sh's suggestion of from 300 to 1,500 kilocycles. Anyone else have a comment?"

T3sh held his breath. He was mostly

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concerned about Avn3, who had consistently argued against any of T3sh's recommendations for the past several years. For a long time, he'd wondered what Avn3 held against him, then finally concluded that Avn3 had no specific quarrel with him, but simply resisted any new idea he had not thought of himself. Avn3 was a fine technician and highly respected for it, but rarely had an idea of his own to offer. Sure enough, it was Avn3 who entered next.

"With all due respect, this discussion is out of order and should be stricken from the record. Chairman M3zzok's agenda clearly indicates that we are now supposed to be determining the nature of the signal to be sent, not the means. If we do not first decide upon the signal, we are likely to overlook, by default, the optimim method of transmission. We may even find that this discussion of electromagnetic wavelengths was a waste of time."

Chairman M3zzok entered ALT F11, signaling a moment of silence for his deliberation. The conferees stood by their terminals, waiting. T3sh inhaled deeply, hoping for an answer before he had to exhale and breathe again. It was a kind of unconscious superstition with him. Deep in his psyche, some part of him almost believed that holding his breath would hasten a decision.

T3sh's lungs were near their breaking point when Chairman M3zzok began his entry. Finally he could exhale and draw another breath as he read his screen.

"It occurs to me," M3zzok entered, "that there may be some value in T3sh's line of reasoning. I could wish that we had made more progress in reconciling 'chaos' and 'older' lines of thought about the arrow of time and other matters. However, it is my present belief that what we now call 'chaos' will eventually resolve itself through standard methods of calculating statistical probabilities. I therefore find it an acceptable hypothesis that the civilization we are trying to reach out there has reached very nearly the same level of technology as ourselves. In any case, there are two premises that I find compelling." There was a pause, then another entry of ALT F11 signaling *STAND BY*.

This time, T3sh did not hold his breath, knowing from experience that Chairman M3zzok was only taking time to choose his words.

He did not have to wait long. M3zzok continued after a brief moment. "First, our target civilization must necessarily have reached a degree of technological sophistication very close to ours to be even listening for a signal from a planetary system other than their own.

"Second, we do not have the capability of sending a signal that would correspond exactly to that of a civilization significantly more advanced than our own.

"It follows that we must send the kind of signal that we ourselves would expect to receive. Now record this: Beginning this evening, we will begin tight-beaming signals from each of our transmitters at twenty-degree intervals along our equator and those at our north and south poles. These signals will be sent at the maximum power our budget permits. We will use amplitude-modulation carrier frequencies which will scan the band 100 to 1,500 kilocycles. That is a firm decision and a directive. We will do this for three years.

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"Now, is there any other topic of discussion today?"

Avn3 entered immediately. "With all due respect to the chairman and all of you, may I plead again that we return to the agenda and discuss the nature of the signal to be sent on these AM frequencies?"

T3sh smiled when he read Avn3's entry. Poor agenda-minded Avn3, he thought. He's so far out of the inner circle that he doesn't yet know what was decided weeks ago over a lunch-time network chat. Chairman M3zzok himself had suggested, and we all agreed, that we would send the simplest, most elementary arithmetic signal, a count-up from 1 to 90. This count would be transmitted in the ancient arithmetic from which all higher mathematics on Zzymbur had derived: an arithmetic consisting solely of 0 and 1. The signals would be generated by a sine-wave oscillator and subjected to infinite peak clipping, resulting in essentially a square wave. For budgetary reasons, the duration of the transmissions would be limited to three years.

December 20, 1999.

The little plastic Christmas tree Miss Harris had placed in the center of the conference table did nothing to lift the spirits of the StarBowl staff.

"Well," said Dr. Ward, "even with the five-year extension the board gave us, we've still come up with nothing on the broadcast band." He looked at Harlingen Pierce, but Harley was staring at his folded hands.

Miss Harris shook her head. "We were all very proud of you when you talked them into eight years instead of only three."

"No, that was mostly Harley's doing. When I retired to an advisory position back in '94 and suggested Harley should be director, he let them think he wouldn't take it unless he could continue his pet project."

"What exactly did the board say this time?" Melissa asked. "When do we have to go back to just 1550 MHz?"

Ward took a deep breath. "We have already. They insisted that the broadcast band is too short range and the budget can't support it any more. They were adamant on their cut-off date. That was yesterday. Harley took the computers off the broadcast band at midnight."

December 29th, 1999

Binary signals from Zzymbur, a planet somewhat less than 8.2 light-years away, began arriving at Earth today. A few billion radio listeners almost noticed faint static behind their Top Ten vocodopunk records. ■

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Kent Patterson
CREATIVE CONSTRUCTIONS, INC.
Conquest can be subtle and insidious—but, just occasionally, not without its compensations. . . .
Broeck Steadman

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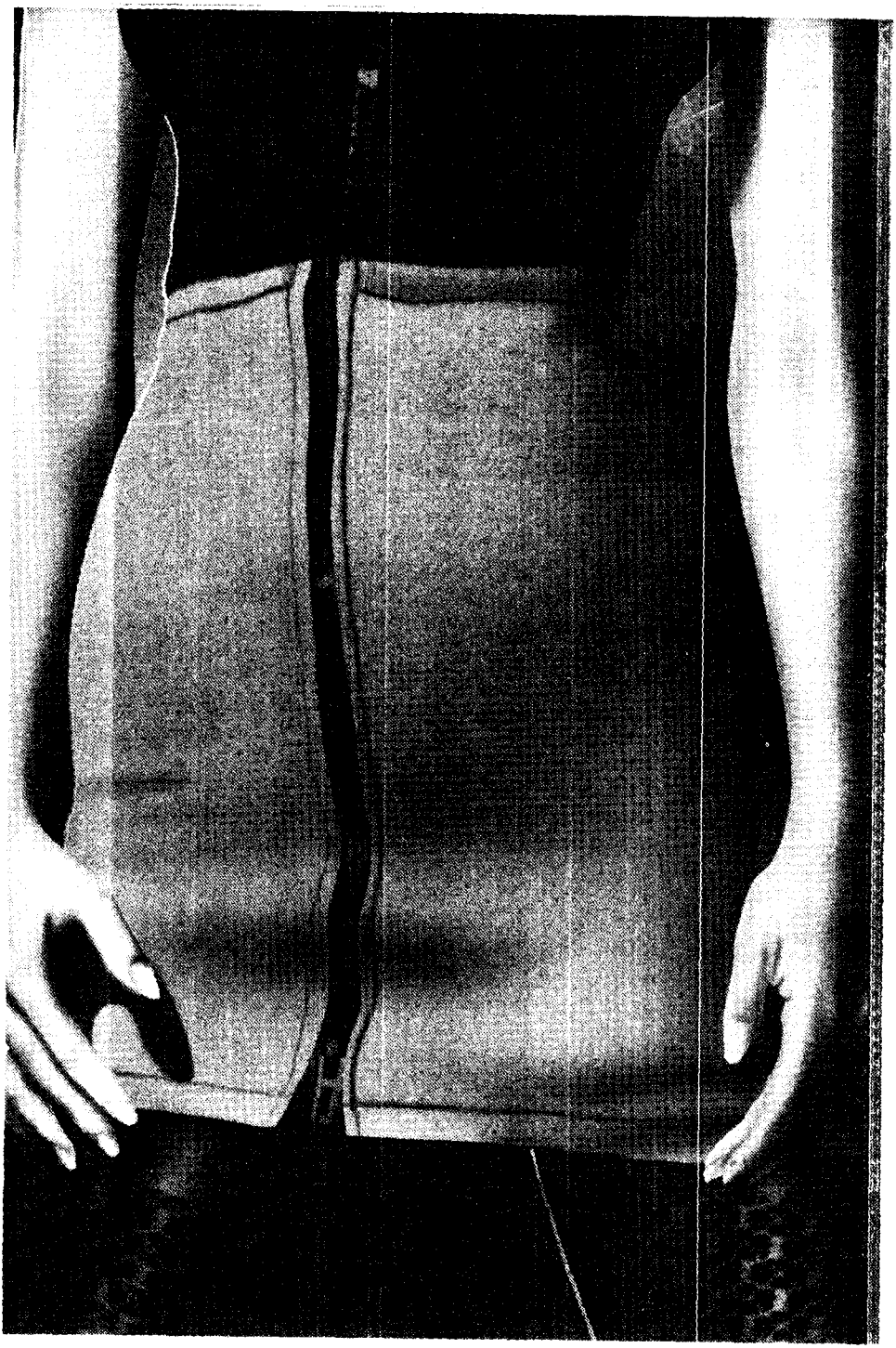

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The problem with the music business, John Hansell thought as the ringing of the phone shattered the riffs he was laying on "St. James Infirmary," is that the business keeps interfering with the music. Carefully he laid his clarinet back in its case. He reached across his Victorian antique roll-top desk (fake, but still nice), neatly avoided disturbing the tsunami of invoices, order blanks, catalogs, and computer disks, and picked up his autographed photo of Charlie Parker. It went back to its place of honor in the top drawer.

Only then did he mop his brow. Two hours of practice, and he looked—and smelled—as if he'd been digging ditches all day. Hot and sweaty. Only his playing was cold. In just two weeks, the Mello Tones were auditioning, he thought. How could he have been created with such a drive to play and so little talent? He'd started at six, practiced for thirty-five years, and it was always the same. In his mind, he could hear each note—God, he could *see* the notes, flickering in his mind's eye like schools of goldfish. But his fingers could never find the right keys in the right time.

Slumped over with discouragement, he picked up the ringing phone. He wasn't even good enough for the Mello Tones. Lord knows they were third rate at best.

"This is Arlene Stoltz, of Stoltz Reality, sole distributor of Creative Construction fine homes," said the phone in a breathy voice. "Mr. Hansell, we have your dream house ready."

"You've got the wrong number. I didn't order any house."

"Creative Constructions is so sure you'll be pleased with our concept, we *know* you'll love this house enough to buy. It's on the lot on Rose Petal Street you love so much."

"Look, I rode past that lot on the bus not two hours ago. You can't build a house in two hours." He put one foot on his desk, leaned back, and looked at the poster of the Austrian Alps on the opposite wall. Come to think of it, how did she know he liked that lot?

"Creative Constructions, Inc., uses Extraterrestrial technology," Ms. Stolz said. "Your dream house in an hour, or there's no charge on construction."

"Extraterrestrial! Are you from the UFOs?" Hansell sat bolt upright. The UFOs had come only two months ago, and already they were underselling every business in every country on every conceivable type of merchandise.

"I am not an alien. I do represent their business interests in real estate for this region."

"Oh, I understand, I think." At least he wouldn't have to deal with anything that had tentacles. But then no human had ever seen one of the aliens.

"Your dream house is ready now." Ms. Stolz sounded smug.

"Unbelievable!" Hansell leaned forward over his desk, hiking his belt higher over his belly. Not keeping up with his jogging lately. Could even super-advanced aliens really build a whole house in a couple of hours? Maybe it was some kind of advertising come-on.

Nothing else stirring. He glanced through the supposed to be but not quite sound-proof glass of his office at his

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personal empire: Hansell's Musical Emporium. CDs, DAT cassette, or Micro format. Big Hits for Baby Budgets. From Blood Vixens to Beethoven at bargain prices. Long racks of CDs and tapes, the rock section cordoned off with plastic chains as if it were under quarantine. Sure as hell no extraterrestrial high tech here. Not a paying customer in sight. If Sarah typed half as energetically as she chomped her gum, she'd make secretary of the century. Gary, as usual, was out drinking lunch. Four Martinis and a Danish. Hold the Danish.

Diane Salsam was the only one worth her pay. She ran the rock and pop section, kept the teeny rockers off his back, and, just incidentally, turned in about 80 percent of what profits there were. But her miniskirt flashed a great deal more thigh than recommended in the *Career Woman's Guide to Professional Dress* he'd carefully left on her desk. This morning she'd lugged in a bigger than life-size cardboard cutout of some young thug in a spiked hairdo and black pantyhose. Hansell made her hide the horrid thing in the back room. Now she pouted in the corner, playing a CD that sounded like a chain saw cutting through a tin tub full of beer bottles.

Outside, the eternal Oregon winter rain spattered the windows and trickled down the glass. Post Christmas, you might as well shut down for a month. Business strictly BC, Beyond Comatose. He'd humor this crazy real estate woman. Anyway, it was a free ride home and beat riding the bus.

"Look, you better not be putting me on."

"I'll be right over." She hung up.

Could it possibly be true? A house in an hour? Hansell stretched. His belt popped back in place. The aliens, ETs, or whatever the hell they were had turned business on its ear. For years people had talked about possible invaders of Earth being everything from brain-eating slime balls to superhuman peace givers. Who'd believe they'd turn out to be a cosmic K-mart with the gut instincts of a Diamond Award Amway distributor?

The bureaucrats had tried to keep the invasion secret, of course. They'd discovered (A) it's hard to keep someone secret when they're lighting up the night sky with banner commercials visible from Maine to Honolulu (and that was only the US version), and (B) the aliens were friendly, which was just as well, since there was no way to get rid of them. Some born againers had tried driving them away with fasting and prayer. One of the dottier third world dictators had even fired a couple of thermonuclear missiles at one of their ships. The missiles had vanished as harmlessly as the prayers.

Hansell put away his battered clarinet case and stepped out of his office. "Diane?"

"You want to take some time off?"

"Please. You can handle the store?"

"It's a big responsibility for a poor sales girl who don't know nothing about selling."

They'd played this game a hundred times. "OK, Diane, you win again. Put up your statue, or whatever you call it."

"Thanks a lot, Mr. Hansell." Instantly she was all sunshine, racing to the back room with her miniskirt flirting over what were actually very nice legs.

The hell of it, Hansell thought, was

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that she was right and he was wrong. As usual. That thing would probably sell a hundred albums. Diane was a high school drop out, and a hard rocker right down to her fishnet hose, but she had more business sense than a whole bar full of Harvard MBAs.

Ms. Stolz turned out to be a thickish woman wearing an orange blazer, matching skirt, and ruffled white blouse. She looked like a hazard cone with blue hair. Drove a maroon station wagon smaller than Connecticut, but not by much. Even through the rain fogged car window you could see her eyes glitter with greed, duplicity, and money lust. Perfect salesperson. Too bad he couldn't get her for the store.

"All Creative Construction homes are Resident Friendly," she bubbled as Hansell slipped into the monster station wagon.

The station wagon shot out into the street directly under the front bumper of a log truck. The trucker hit the horns and brakes together. "Creative Construction homes have totally Automatic Customer Customized Conformance," Ms. Stoltz babbled happily. She hadn't noticed the truck. Hansell extracted his fingernails from the upholstery.

Her voice blended with the thumping of the windshield wipers. "Enhanced Living Functionality." Thump. "Full resident selectable Comfortability." Thump. "Self-actualizing energy efficient Modularization." Thump. Hansell wished to hell he hadn't come.

Until he saw the house. He boggled. No other word for it. Just this morning it had been a vacant lot. Decaying weeds high as his head. Tin cans, candy wrappers, dead condoms, bed springs and the rusted half of a defunct Datsun. Now a house—a dream house—low, slate grey roof, Victorian-style bay windows (Hansell had always been a sucker for bay windows), genuine-looking sandstone trim. ET tech or no, a miracle. Not to mention the landscaped lawn, box hedge fences, and an enormous oak which must have been teleported from Sherwood Forest.

"Unbelievable!"

"Seeing is believing, Mr. Hansell."

Hansell followed her to the door.

"Just say your name, Mr. Hansell."

He did. The door opened as quietly as a marshmallow on a butter cube. It didn't even go "shoop."

"Note the Oriental touch in the Main Living Area," Stoltz said. "The gold and enamel dragon is a precise replica of the emperor's in China's Forbidden City. No extra cost."

"How did you know I liked Oriental?"

"Our research guarantees full conformance with every customer's wish." She paused dramatically. "Mr. Hansell, we know your every slightest desire."

Sure as hell hope not, he thought.

Especially when he saw the bedroom. Silk is so sensual. Embarrassing even with Ms. Stoltz, who was about as alluring as a furniture van. Imagine this with someone like Diane, Hansell thought, feeling guilty and wicked, and enjoying it.

"Now the food processing area," Stoltz said, pulling him by the arm.

The kitchen looked more like Tinker Belle's playroom than a kitchen. A tree stump maybe six feet across formed a table. Not a dish in sight.

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"Range," she snapped. A glass box rose from the tree stump. "All cooking modes from hickory smoked to microwave. Totally menu-driven. No programming." She smirked. "Your entire menu is menu-driven." Salesperson's joke, carefully processed to remove traces of humor. She reached into the tree trunk, pulling out a mug of beer. "Heinrich's Gold draft, pre-chilled mug, 38.2 degrees Fahrenheit. Your favorite, I believe?"

Hansell never drank while doing business. But right now he felt far drunker than any Heinrich's Gold could make him. The music room clinched the matter. The sound system played Holtz's *The Planets*, the Berlin Philharmonic version with Wilfried Von Isling conducting. Hansell let the music flow through him. Bit dead on the upper register of the second violin—no. One of the kettle drums too tight—no. Incredible. The second he spotted the slightest flaw in the music, it seemed to correct itself. Pure magic. Marvelous acoustics!

"I'll buy it! How much?"

"Only $149,999.95, complete."

Hansell stood too shocked to dicker. House-wise, $150 K rated a one bedroom cardboard Econobox with a scenic view of the sewage treatment ponds. Bargains like this came once in a life time. "I'll take it!"

A few phone calls with a plug-in computer, and Hansell was the proud possessor of the house of his dreams, and the ETs had a first mortgage on the Musical Emporium.

"Only one thing, Ms. Stoltz."

"Yes?"

"If these aliens can build stuff like this, why do they need money at all? They can't use dollars in some other galaxy."

"Everyone needs money."

"But what can they possibly buy that they couldn't make?" A frightening thought crossed his mind. "Or steal? We couldn't stop them."

She looked at him as if he had two heads. Obviously, the discussion was too abstract for her tastes. Gathering up her papers, Ms. Stoltz jumped in her car and roared off into the rain.

Hansell swept grandly from room to room, intoxicated with joy, loving it more and more. He downed another couple of perfect Heinrichs. Now, he thought, grab a quick shower, call up Diane—er, Millicent. He hadn't seen her for two weeks. She never had time for him. But this house might change her mind.

Out of his suit, into the shower. "Figaro, Figaro, Feeee-gaa-RO!" He'd never sounded better! Maybe he ought to play clarinet in here. "FEEEEE-GAA-RO!"

When a large hand clamped down on his shoulder, the shock made him squirt the soap clear across the shower. The hand was attached to an even larger cop. "What the hell are you doing in my house?" Hansell flustered.

"Come in, Central, come on?" The cop said into his walkie talkie. "Yeah, Sue, it's me. Hey, here's one to tell the grandkids. Guy's ordering me out of his house."

"So what? So would I."

"Yeah, but he's yelling 'Figaro, Figaro' in the middle of a vacant lot standing bare-ass naked in the rain."

* * *

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Hansell spent two hours trying to convince the cops he wasn't drunk. Then, as he realized any alternative explanation could only be worse, he spent four hours trying to convince them he'd been very drunk indeed. Finally, at midnight, they released him with a warning, gave him a garment somewhere between a nightgown and a table cloth, and let him call Millie. When she drove up in her elderly Chevy, she didn't look amused.

"Thanks so much, Love," he said, trying to placate her. She was not placatable.

"I won't stand for it, John. I won't stand for exhibitionism. I don't want to go with a flasher."

He didn't say anything, just watched the rain sweep across the road in front, and smelled the car's odor of cigarette smoke, Millie's lavender perfume, and mildew.

"They said they found you down on Rose Petal street. That's near St. Mary's School. Were you flashing the little girls, John?" Her eyes glittered as she turned to look at him.

"It's two miles from St. Mary's, there were no girls, little or big, and I'm not a flasher."

"Dr. Rosemary Bosley talks about the male being intimidated by successful women. So I intimidate you, and so you flash little girls."

Hansell groaned. Millie read Rosemary Bosley's column on "Speaking of Men" religiously. Every month the good doctor pointed with alarm at some new horror she'd discovered tucked away in the male psyche.

"So how's the venerable Chevy running?" he said. Not a brilliant comment, he realized as he said it, but anything was better than Rosemary Bosley.

"John, are you insane?" Millie turned to look at him. "This car is brand new. I got it just this very day. Look at this genuine split grain leather upholstery. And you used to make fun of my scratchy old radio? Well, try your supersensitive musical ears on this stereo." She turned on the scratchy old radio, which sounded scratchy. Hansell looked at the upholstery. It looked just the same as it had for years, only older. A flickering suspicion sneaked into his mind.

"Where did you get the car?" he said.

"From Creative Constructions Automotive, *of course*. A steal!"

"Yes. A steal."

Hansell had never been so glad to see his own apartment coming up. Millie pulled into the driveway, and he opened the door. "Thanks a lot, Millie."

"Who's that woman waiting for you?" Millie's voice would have frozen a polar bear's butt.

Hansell turned. Standing under the street light was Diane.

"Hi, Mrs. Hansell." Diane waved. As she waved, her coat opened in front. She wore a black push-up bra and a patent leather microskirt so short it showed the tops of her hose.

Millie shot the gas to the old Chev and roared off.

"She's not Mrs. Hansell, Diane. And what in heaven's name are you doing here at this hour?"

"Well, me and the boyfriend saw this mega awesome new motorcycle from those aliens, you know. I'm sorry, Mr. Hansell, cause you've been good to me, only I'm quitting. So I need my pay.

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For the motorcycle." From somewhere the boyfriend materialized, a bearded giant in a Nazi helmet. He had a swastika tattooed on one hand and was wrapping a motorcycle chain around the other.

"Sorry to see you leave, Diane. I don't have the cash on me right now, but . . . umph!"

The giant drove his chained fist right into Hansell's stomach. Diane screamed. Hansell dropped to all fours, his stomach burning.

"Don't hit him, you dummy!" Diane slapped his black leather jacket. "Go, get out of here before somebody calls the cops. Touch him again and *I'll* call the cops."

Dummy argued, but Diane slapped and pushed him away. She came back, helping Hansell to his feet.

"I'm so sorry, Mr. Hansell. He don't know his own strength." She put an arm around him to help him walk to his door. Even with his stomach in flames, Hansell was conscious of the warmth of her body, her breasts showcased by the push-up bra. And her smell. Cheap powder, cheap perfume, and even cheaper whiskey. He should have paid her more.

Once inside, she looked around in frank curiosity. The room was lined with bookshelves, nearly every book about music. A grand piano took up half the living space. A computer, printer, and work desk took up most of the rest. Virtually every level space was stacked high with computer printouts.

"Wow, what a big piano you got," Diane said. She looked at some of the printouts. "This is all music. Did you write it?"

"Yes, Diane. I write it and print it out on the computer."

"Boy, there's tons of it. You should send it to a record company."

"I have, Diane. And I've got more rejections than McDonald's got hamburgers. My style of music isn't real popular now."

"You should write some bitchin' hard rock. It sells like mad."

Hansell said nothing. Diane drifted off to the kitchen to make some drinks while he wrote her a check.

"Thank you so much, Mr. Hansell." She stuffed the check in her bra. "I'm sorry Danny hit you. He's so hot tempered."

"He should be arrested."

Diane looked frightened. "Please don't, Mr. Hansell. He's already on probation. They'd send him back to prison for years. He doesn't mean anything by it. He hits me all the time. See where he kicked me this morning?" She lifted her skirt to show a large bruise on her thigh.

Diane's lack of modesty didn't shock Hansell. The ugliness of the bruise did. "My, God, Diane. You can't possibly go away with this man! He's crazy."

"Yeah, he is, sort of. But he loves me, and he's always sorry."

"Sorry doesn't cut it, Diane. And you don't kick people you love."

"Most men do, don't they? Do you ever hit your girlfriend?"

"Never!"

She looked at him. "No, I bet you really don't. Thanks, Mr. Hansell. You're very nice." She leaned over, kissed him lightly on the forehead, put on her coat, and walked to the door. Suddenly she turned back. "Only when

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you want to look at a girl's legs, just look. Don't peek. Peeking makes her nervous." Then she was gone.

Hansell stared at the door, then laughed. He had had that remark coming. He'd miss Diane. She deserved a better break than roaring across the nation on a motorbike with young Attila the Nazi. Good salesperson, too. She sold more music than everyone else put together, including him. The Emporium would miss her as well.

A cold hand clutched his heart. He'd just mortgaged the Emporium right to the hilt, and he had nothing to show for it. He smiled bitterly. Maybe he could get a lawyer in the morning. His stomach hurt. Bent over like the hunchback of Notre Dame, he hobbled off to bed.

He'd overslept. Bright orange light streamed through the curtains. He sat up in bed, wincing when pain streaked through his stomach. That much sunlight in Oregon in January? No way. He got up and opened the curtains.

A huge orange arrow shimmered in the sky. Letters crawled across the arrow. "SUPER SELLABRATION! GALAXIES OF GOODS ½ OFF!" The arrow pointed directly to the covered football stadium, the biggest building in town.

The light flowed through him like music, gently massaging the pain from his stomach, the doubt from his mind. What marvels would the aliens be selling? He basked like a cat in the sun. What fantastic goods—damn!

Hansell started back. He'd nearly been hypnotized. Well, he swore to himself. These aliens may lead everyone else by the nose, but not him. Swindle me once, shame on you. Swindle me twice, shame on me. He threw on his clothes, his raincoat, and walked to the bus stop.

He was a bit surprised when the bus took him straight to the sale.

Everyone was there. The stadium glittered with thousands of lights. Cars and buses brought more and more people. Babies in strollers peered intently at the orange sky as their mothers battled through the crowd. An elderly woman, her hair a mere dandelion fuzz shining in the orange light, shoved Hansell out of her way. A small boy ran into him, bounced off, and raced on.

Pushed along as helplessly as a leaf in a stream, Hansell soon found himself inside.

The entire football field had been floored in and covered with long tables. The crowd flowed around the tables like a huge brown flood. Women chattered, men bellowed, and the high pitched shrieking of children made Hansell happy that Millie refused to marry him. Cutting through the clamor, a calm, incredibly sexy woman's voice spoke into Hansell's ear. "Try Aisle 49A, table 16, for the very best in ET music reproduction. You won't believe your ears."

Hansell looked around. The voice came from inside, not outside. Everyone heard his or her own voice. They pressed like maniacs to get to the tables.

Standing on tip toe, at last Hansell saw the tables themselves. *They were absolutely bare.* People fought, haggled, elbowed each other, and there wasn't one thing on any table in the room. He felt like shrieking with hysterical laughter, and did. No one no-

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ticed. Nobody noticed anything. Was he the sole sane person in the world?

Why? Why? Why were these aliens so money hungry? They were all over the world and must be racking in billions, but what could they possibly buy?

He had to get out. Pushing his way down an aisle, eventually he neared the EXIT sign. Then, through the corner of his eye, he sighted a woman who looked like a hazard cone.

"Ms. Stoltz!"

Her eyes glittered. She leaned over a table, grabbing nothing, and stuffing nothing into a gigantic shopping bag.

"Ms. Stoltz! May I speak to you a minute?" Hansell bellowed into her ear.

She didn't hear him. He grabbed her firmly just above the elbow. "Ms. Stoltz!"

She spun around. Hansell hung on to the elbow.

"Let go of me!" she shrieked.

"Ms. Stoltz, you sold me a house and I insist you talk to me."

Suddenly a very large, and distressingly familiar, hand descended on his shoulder. By some incredible bad luck, it was the same cop who'd arrested him before.

"Well, John. Up to your tricks again, hey?" he said. "Maybe you'd like another little visit down to the station. Only you won't find this one quite so funny. So maybe you'd better just leave."

Hansell, who hadn't found the first trip to the station overwhelmingly amusing, left.

He couldn't get a bus going home. The ETs had them all. So he spent two hours walking home in the rain with the orange light of the ETs advertising glittering on the wet sidewalk in front of him.

He couldn't figure it out. Not one person seemed to question that the ETs goods were real. Neither had he. That house was as solid as any house he'd ever been in. Only it vanished. Now he seemed to the only one in town—maybe the world—who knew the ETs were fake. Or maybe he was just crazy. Maybe he ought to see a shrink. "Yes, Doctor. I bought a house, and it vanished, and so there I was, naked, and the cops took me in, and could you cure me?" Hansell grinned. A story that daffy would put him in the loony bin for sure.

As he finally neared his apartment, he was astonished to see Ms. Stoltz's maroon station wagon parked in front. Inside was Ms. Stoltz herself.

"I've got to talk to you," Stoltz said. "The ETs want me to give you a contract."

"What?" Hansell tried to focus his mind. "I don't understand."

"I don't either, since you haven't done nothing but complain about that wonderful house. But here it is." They went inside.

Sipping coffee, Hansell read the contract. The ETs would drop the mortgage in return for half of all future profits of the Emporium, which was crazy. The Emporium had never made much more than a bare living. With Diane gone, and everyone in town spending every last nickel at the football stadium, the ETs wouldn't get much. Not a penny, if he could help it.

The contract seemed to be tight, but there was one glaring loophole. And it was a doozy. Hansel read it five times

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to make sure he had it right. No mistake. According to the contract he had credit to order music, sound equipment or to contract with musicians to provide music, or even to support worthy musical goals—that was a rubber clause if ever there were one. He would be paid 10 percent of the costs of all such orders and contracts. Not profits. Costs.

He poured himself another cup of coffee. Clever as they were, the ETs had much to learn about business. This loophole wasn't a loophole, it was a legal freeway. What was to stop him from ordering, say, $1,000,000 of something weird, charging it to the ETs, pocketing his $100,000, then selling the CDs at two cents each? Or maybe just giving them away, or using them for frisbees?

He called Millie, to see what she would say, but she didn't answer and he had to leave a message on her machine. So he'd have to decide alone. Actually, he'd already decided.

Hansell considered himself an honest man, but then the ETs had swindled him. He signed the contract.

Ms. Stoltz gave him a credit voucher the next day, which he considered commendably fast. He went to his office, got comfortable, put "Rhapsody in Blue" (the new one, with that spine tingling clarinet by Whizzer Lewis) on the player, then picked up a catalog. In fifteen minutes he ordered over $2,000 of music he'd always wanted, or thought would be nice, or looked interesting. For once, he didn't worry whether it would sell.

That was $200 for him—not bad pay. But the ETs couldn't be that dumb. Did they even have to follow the law? What if—well, what if what? Deliberately, he picked up the catalog and ordered $10,000 more.

The next months were wonderful. He bought the best: classics old and new, traditional African folk rhythms and some extremely interesting modern compositions which blended African rhythms with Western melodies. Tons of jazz. He started a collection of old 78s, and hired a firm to restore them.

The ETs paid the bills without a murmur.

He wondered what kind of music the ETs had. Maybe none. But he couldn't believe that. Every human tribe, every ethnic group, had created some kind of music. Hansell loved nothing better than getting music from all around—eskimos, Latin American Indians—everyone had at least a few worthwhile pieces, and some obscure groups had works of real genius. He bought them all, selecting the finest for his collection. He even got to sending money—ET money—to artists he liked. Some of them, especially in Africa and India, were nearly starving. For a few hundred dollars each, Hansell saved their lives. He'd never felt so good before.

Only he flunked the Mello Tones audition. He called Millie for sympathy, but what he got was a Rosemary Bosley lecture. Bottom line, as the bean counters say, was that Millie had found better things to do with her time and a better man to do them with. She didn't want him to call again. Not ever.

That night he tried to console himself by playing a few riffs from "St. James Infirmary," thinking his depression would flavor that blusy music and he'd

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sound great. He sounded like he always did, a Mello Tones reject. So he got roaring drunk, the procedure recommended for broken-hearted males in all the literature.

He got nothing out of it but a splitting headache and a new resolution. He'd play clarinet, write music criticism. He could get along without Millie. She'd never really listened to him. In fact, she hardly ever had time for him. So if he had to be lonely and horny anyway, he might as well be lonely and horny by himself.

Hardly anyone ever came by the Emporium now, but the few who did were quality. Musicians. Professors. Collectors. No teenies, no rockers, punk, hard, new wave, or whatever. Hansell loved the conversations. Some stayed for hours, talking the kind of talk he'd never got enough of before. Once in a while one even bought something.

He donated $100,000 to the struggling local opera company, and when they opened with *Aida*, his name was on the program.

A patron. That's what he'd become, a patron of the musical arts. He loved the sound of the word. He supported symphonies, composers. When his favorite magazine, *The Critical Ear*, went bankrupt, he bought it and hired himself as chief critic. He had a knack for it. His critiques sold well, and the magazine lost only a little per issue.

He was sitting in the empty Emporium writing his *Critical Ear* column when a woman walked in. She wore a shapeless green granny dress straight from Goodwill. Huge dark glasses hid her eyes and much of her face.

"Hello, Mr. Hansell," she said.

"Diane!" Now that she was closer, he could see why the dark glasses. A grey-green bruise covered half her face.

"Diane, you're hurt."

"I been beat and beat 'till I can't hardly stand it no more." She glanced around at his newly decorated store. "Boy, this place is so fancy I feel funny coming in here." She pointed at the magazine rack with the *Critical Ear* on display. "And now you're getting famous. Maybe I should go."

"No, stay. You were my best salesperson ever."

"Mr. Hansell, you were right about Danny. He took every cent I ever made and dumped me like a smelly dog. I haven't had nothing to eat in near two days. If I could only have my old job back."

"Nothing to eat in two days! Sure, you can have your job back. Only now let me get you lunch."

It was while she was finishing her second Fat Boy burger that the big idea came to him.

"Diane, I think I can give you something better than your old job back."

She glanced up, a french fry dangling from her mouth, and suspicion in her eyes. "What you got in mind?"

"How would you like to start your own store and be the manager? The place next to the Emporium is empty. You could move in there, and take the rock and pop part of the business. You handle the teeny crowd so well. I loan you enough to get started and pay your wages until you get going, then we share profits."

He'd expected her to be surprised. He did not expect her to be dumbfounded.

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Color drained from her face, and the french fry in her mouth quivered like a leaf in the wind.

"You're not joking? You mean like my own store with my own name on the front?"

"Sure. Any name you want."

"Mr. Hansell, I don't know about managing, I—"

"You can learn. I learned, and you're a bright girl."

"Nobody ever gave me nothing before."

"I'm not giving you anything. I'm hiring you."

"I'd love to try it. I'd do anything. I'll wear what you want me to this time."

"No, Diane. This time you'll wear what you want. You'll be boss."

She burst into tears. Embarrassed, Hansell tried to look somewhere else, anywhere else.

Diane's was a hit. In a fury of work, she decorated the place with long black fake leather curtains held in place with huge steel (plastic really) spikes. For the music, she installed a rack. Literally. A twenty foot replica of the medieval torture device, only covered with CDs instead of elongated peasants.

The teenies loved it. In six months, *Diane's* was turning a fat profit, and she needed his help like she needed an IRS audit.

Which was what he told her when she invited him over after hours to brag about her latest sales figures. She wore a simple black blouse and a skirt made of some clingy stuff which reminded Hansell of those 30s movie queens. She looked every bit the sophisticated woman of business. Even her grammar had improved. Usually.

"Diane, you've done marvellously. really great," Hansell said. "You've got a talent for business, no question."

"Thank you." She almost blushed. "Here. I want to show you something I got just today." She pulled a small packet from her purse and handed it to him. "You got so much education maybe it's not much . . ." her voice trailed off.

He opened the packet. It was a diploma stating that Diane Salsam had successfully completed the general exams for a high school equivalency diploma.

"Diane! This is wonderful!"

"I've been taking classes almost every night. See here." She stood next to him and pointed at the paper. "Cum Laude. That means 'with praise.' "

"You should be very, very proud."

She made a little wriggle of sheer pleasure. "And now next semester I start taking college classes. Me. Can you imagine? Me a college girl?"

"Sure. Don't put yourself down. You're really bright. I can see you as a Ph.D."

"No one else ever said things like that to me. Never once. Only you. Especially men. They take one look at me and they think 'Hey, there goes an easy lay.' I got so much of that even I looked at me that way. Only you saw more."

She laughed. "You saw something more, and nagged until I start seeing it too. Only you saw it first."

She stepped to the house stereo and put on a CD—Glenn Miller Gold, much to his amazement.

"I know you like this one because

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you raved so about it in your column," she said. She brushed her hair back with one hand, smiled beautifully, then stepped up next to him.

"And now, kind sir, may I have this dance?" she asked.

At first they nearly tripped over each other. But he showed her the classic steps. Hansell loved dancing, and had once been fairly good, but he hadn't danced in years. Feeling her warmth against him, he wondered why he never kept it up. Sure as hell beats jogging.

"You don't even know what you done for me, John." What's this, Hansell thought. With that liquid music, even Diane was getting sentimental. "You do things for everybody. All them musicians, and the opera. Everyone comes to you for money, for support and you give and give, and they go away."

She looked directly into his eyes. "When do you start asking for what you want?"

He would have answered her immediately, only the thought of his own unselfish nobility choked him up to the point where he could hardly speak.

She stepped back and smiled. "I'm going to teach you to ask for what you want." Slowly, she slipped out of her blouse. "Now you can stop peeking." He took her into his arms and she pressed herself against him. "Ah, ha," she laughed. "You're too shy to say so, but you really, really do like me, don't you? I love you, John. Maybe not next year, maybe not even tomorrow. But right now I love you."

Next morning came along about noon. Hansell went home, staggered to the kitchen, and poured himself a cup of coffee which the automatic maker had been stewing since 7:00 in the morning. He felt guilty, which was bad, but better than feeling lonely and horny. Last night they'd exploited youth and innocence. Her youth; his innocence.

The door bell rang.

"Ms. Stoltz!" She looked extremely upset, as if she'd been crying. Her skirt was rumpled, and bits of food speckled her vest. She'd lost weight.

"I'm not coming for myself, Mr. Hansell," she said. There was none of the old spark in her. "I come for the ETs. They've sold their entire stock and so they're leaving tomorrow. They'll not be back for maybe twenty years. They want a new contract while they're gone." Her voice became whiny. "I have hardly slept or taken time to eat since they got here. Eighty, ninety, a hundred hours a week—and you don't do a thing but spend money and it's you they want." She seemed on the verge of tears.

"I don't trust them. They're up to something, and they're not having me."

She stared as if she didn't believe him. "But they'll make you rich."

"I won't sign any contract unless they show themselves. I'm tired of working for ghosts. You tell them that."

"OK, it's your funeral."

Hansell wished she could have found a better term. For a few seconds, she shut her eyes. Then she nodded.

"OK. They'll see you now."

"Now?" Hansell tried to play unconcerned, but somewhere in his head some old movies about brain eaters from outer space played. God, I hope they don't have tentacles, he thought. But

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where would they meet? Would they come here? More likely, they'd take him into space. He'd never been into space. He wondered what it was like.

"What must I do?"

"They say just walk into your hall closet and close the door."

"That's ridiculous!"

"That's what they say."

The hall closet was so small he had to take out his exercise set—which he'd used once—to get in. Then he wedged himself in and shut the door. He saw exactly what you would expect to see inside a dark closet. Nothing.

This is really stupid, he thought, reaching for the door handle.

The closet vanished. It didn't turn glittery, or make a strange noise, or do anything but just not be there anymore. In its place was a huge, transparent dome, the size of a gymnasium.

He was on an ET space ship. Just like that. Looking through the transparent ceiling, on one side he could see the vast blue circle of the Earth, on the other nothing but the star-specked blackness of space. Hansell looked carefully. So it was true what Ms. Ting said back in the first grade. In space, stars don't twinkle.

"Hello, Johnny. So nice to see you."

Hansell spun around. There was Ms. Ting's old desk. With the globe that Ms. Ting liked to spin while she talked. Behind the desk was Ms. Ting.

She looked just as she had looked back then. Motherly, with flecks of grey in her hair, a dress as innocent of style or fashion as it was of gold braid. On her left breast was an enormous pin, an American flag in glittering red, white, and blue glass. Her class had donated a quarter each to buy her that pin for Christmas, and she wore it as proudly as another woman might have worn the Star of India.

"Ms. Ting, I . . ." Then he remembered her real name had been something like Tilsingly, too many syllables for first graders to negotiate, so she had them call her Ting.

"Just call me Ms. Ting, Johnny," she said, her voice warm as always.

Only thirty years of severe training in elementary manhood prevented him from dropping down and pressing his face against her knees like he had done the time when he'd fallen off the teeter totter and fractured his wrist. But something was seriously wrong here.

"You're not Ms. Ting," Hansell said.

"No, I'm not. But Ms. Ting has warm associations in your mind."

"What are you trying to do to me?"

"Please you. After all, we are salespeople—"

Hansell frowned.

"Very well. Sales *creatures*, if you insist. But we always appear in a shape which the customer likes. Your own salesman do the same, do they not? You want to sell to IBM, you wear a blue suit. Sell to a punk rocker, put safety pins in your nose. Same principle. Only with a few million more years of evolution."

"Not good enough." Hansell doubled up his fists, then relaxed. How could anyone hit Ms. Ting? Even if it wasn't Ms. Ting. "I insist on seeing you as you really are."

"Our only shape is one to please the customer."

"You have no real shape?"

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"Not in any sense you would understand."

"So what are you like when no one else is around."

"What is the sound of one hand clapping?"

Never in his scariest nightmares had Hansell considered arguing Zen mysticism with an alien who looked like Ms. Ting. He decided to take a new slant.

"So why do you sell stuff which doesn't exist?"

"For the money." Absentmindedly, Ms. Ting began to spin the globe. "Why do you find that so hard to believe? Everything we do is for profit, Johnny. Everything."

"But you could just take anything on Earth. You have technology we can't touch. You could just tell us to hand over anything you want or you would blow up New York or something."

Ms. Ting frowned just as she used to when an answer was dumb.

"Why should we blow up New York? We own most of it." Ms. Ting looked at him with warm sympathy. For a second, he thought by some miracle she must be the real Ms. Ting. "We're business people—business creatures, not warriors. My ancestors were negotiating leveraged buy-outs when yours were deciding on one cell or two. There's no profit in war; only primitives think that way."

"So you sell imaginary stuff for money?"

"Not imaginary."

"My house was imaginary. It didn't really exist."

"Certainly it existed. We just turned it off."

"What is it you want?" Hansell's head was beginning to ache. "Gold, diamonds, platinum, sex? What? Surely our money's no good on Boogy Woogy One, or wherever the hell you things spring from."

Ms. Ting sat back in her chair. "Yes, Johnny. The dollar's hardly legal tender in our corner of the cosmos. But it's valuable here. We've made billions — trillions—of dollars, yen, rubles. Now we've invested it." She leaned forward. "We're investing in Earth like you Earthers invest in a farm. In twenty of your years, a short time to us, we'll be back for our harvest."

"A harvest of *what?* We aren't milk cows. You can't eat us." He looked at her suspiciously. "Or can you?"

"You disappoint me. I should think you'd have some fellow feeling for your peers. We're in exactly the same business."

Hansell closed his eyes. Ideas spun around and around in his head. At last things were beginning to make sense. "You're in the music business?"

"Oh, not just music. All primitive art forms. Look at this masterpiece, for instance."

Elmer Fudd appeared on the dome, his finger on his lips. "Be vewy, vewy quiet," Fudd said. "I'm hunting wabbits."

Ms. Ting doubled up in laughter. "Can you believe it? The utter audacity of it? Crude sketches, simplistic color. No prologue, no plot introduction — precisely seven words and you're in the middle of the story." Ms. Ting wiped her eyes. "You have no idea how much Bugs Bunny baffled our technical staff. They searched the natural history of this planet back to the dinosaurs to find the

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animal which served as a model. I still can't believe it's a small rodent. No, Johnny. We'll hand it to you Earthers. Given a rabbit as a subject, any of our artists could have sculpted a model which your best scientists couldn't tell from the real thing. But in a million years they would never come up with a 'wascally wabbit.' "

"So where do I fit in? I'm not an artist."

"On the contrary. You *are* an artist. One of the greatest. We've selected you as one of the top dozen musical geniuses alive."

"What! I can't even play for a third-rate dance band."

"Precisely what fooled our research team. Your fellow humans consider you only as a minor businessman, and—no offense—a mediocre one at that. Diane's infinitely better."

"She is? I thought she just knew kids better."

"No, she has a remarkable commercial mind. Green, of course, but learning fast. She'll soon make you rich."

So if that's true, why do I need you, Hansell thought.

"So you want music," Hansell said. "I can understand that. How come I'm the only one in the world who can't see the stuff you're supposed to be selling?"

"You're not the only one. There's a few others like you."

"How can I find out who they are?"

"With enormous difficulty. Start talking too much about this, and you'll find yourself in a padded cell."

Checkmate, thought Hansell. They thought of everything. "So why did you sell me a house if I was so special?"

"We sold you the house for the money. A routine deal, or so we thought. Of course our marketing computers checked for customer satisfaction. We always do."

She shook her head. "Johnny, you blew our entire research section right out of their chairs. There you were, calmly noting the second violin in our supposedly perfect concert reproduction was a hair off tune. One of the drums too tight. We checked. *And you were right!* Maybe ten people in your entire world could do that. Think of it. We had you down as a common customer, just another sale. And here you are a musical genius, the very person we need. How could we make such a mistake! You can bet I checked in to it. Personally. Our researchers had failed to give sufficient weight to the idea that in a pre-technical society, a musician plays by hands. So this society confuses manual dexterity with musical talent. Advanced worlds would never make that mistake."

"So the house disappeared?"

"Certainly! And we have never, ever once touched your mind since. We never tamper with genius."

"Like killing the goose that laid the golden eggs. With me the goose."

"Exactly. Fool around with your mind, and you'd stop making your kind of music and start making our kind." She laughed. "You can't imagine what a disaster that would be."

"So you gave me all that money to . . . Why?"

"To find good music for us. That money was pennies! Tuppence! Johnny, show some imagination! We sell to whole galaxies." Ms. Ting thought for a second. "Let me explain. Earth is

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such a poverty-bedeviled place that you have no concept of what a real collector is. But even so. Consider what one of your rich Earth collectors would pay for a collection of Baroque music, as personally selected and critiqued by Johann Sebastian Bach? Or English Renaissance drama, special edition, with plays personally selected and annotated by William Shakespeare? In the original handwriting? Believe me, our authenticated John Hansell collection is a great investment."

"So all the time I thought I was taking you to the cleaners, I was only investing your money?" Hansell felt betrayed. The con man conned, the thief who turns out to be disgustingly honest after all.

"And brilliantly! You've picked out new talent, started new careers. And now your critiques are forming the musical ideas of a whole new generation." Ms. Ting stood up, walked over to Hansell, and put her arm around him. "Johnny, you've altered musical history. In twenty years, this whole planet will be making music. Your kind of music. Think of it! And me and my little crew will be selling Earth music to every civilized planet in the Universe. Galaxies for customers, Johnny. Billions of planets."

"And me?"

"We want you to continue, just as before. Pick out the finest music you can find. Write your own. Find young talent, make sure it has the money and training it needs."

"That would take millions."

"Pocket change. We have billions."

"Billions you took from us! You swindled us. You take our money, then spend it to bribe us to do what you want." A thought came to him. "You do the same thing all over the world, you alter the whole economy. The whole world's working to make things you can sell and become intergalactic big shots."

"So in the future, you'll have more concerts and fewer aircraft carriers. You find that undesirable?"

"It's not right! You're making us do what we don't want to do."

"In your case," Ms. Ting smiled. "We're making you do precisely what you *do* want to do."

Hansell sucked up his belly and drew himself up to his full height. "You can't bribe me with money." After all, Diane was going to make him rich anyway.

"Wouldn't think of it. But we can bribe you. Look at this, Johnny." She opened the top drawer of her desk, the one that, thirty years ago, had been a bottomless treasure trove of treats for all good little boys and girls. She took out a bell-shaped object and handed to him.

It looked as if it were made of polished ebony, its black surface gleaming in the light.

"What is it?"

"It can be any musical instrument you can imagine, or an entire orchestra. Only at this moment, it's a clarinet."

"What?" He looked at the smooth surface. "So where do you put your fingers?"

Ms. Ting smiled. "It doesn't need fingers, Johnny. You play it with your mind."

"I can't go out there!" Hansell quivered. It was the Blues Moon talent

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night. The butterflies in his stomach had butterflies. Through the door of his dressing room, he could hear the audience clapping for contestant number 2. He was 3.

"Bull!" Diane said. "Wild horses and Diesel tractors couldn't keep you from going out there." She picked an invisible bit of lint from his lapel. Feminine territorial marking, Hansell thought. She leaned over and whispered. "Got your sacred Charlie Parker picture?"

"How'd you know about that?"

"Never you mind. Now get out there and knock 'em dead. Break a rib. No. Leg! That's right." She smacked him playfully on the rump as he left the dressing room.

". . . who needs no introduction." The MC was saying as Hansell stepped out on to the stage. "For the first time appearing in the Blues Moon, the one you've been waiting for, an out of the world man with an out of this world instrument, Mr. John "Space Angel" Hansell, the one-man orchestra on his one-of-a-kind, ET horn!"

Smoke and dim lights hid most of the audience. Here and there a pair of glasses caught the light and flickered in the dark mass of the crowd. The place was packed. The Blues Moon was big time.

"Now, Space Angel will be playing his own composition called 'Song for Diane.' " The MC shouted. The audience roared.

There were two stools on stage. Hansell put a fancy silk pillow on one, then took the ET horn from its case. With exaggerated care, he placed it on the pillow. The delicate care was pure show biz. The horn was anything but fragile.

Hansell sat down, took a deep breath, then focused his mind. The audience stilled. From some unguarded spot in the back of his brain, a thought came. John Hansell, this is the moment for which you have sold your soul to aliens.

Concentrating, Hansell drew a thin blue line in his mind's eye. The ET horn responded with a high note, so pure, so sustained, it closed out the rest of the world. Then Hansell added a flickering percussion, letting the high note glide down the scale, become fatter, pick up the brass, and little puffs of woodwinds. Then, in a swoop, he dropped the theme note into the basement, a note so low you didn't hear it, it came creeping up from the floor and rattled the very marrow of your bones.

The audience gasped with astonishment.

A sound like that, Hansell thought, that pure, that strong, is worth any man's soul. ■

●Ambition gains control of little men more easily than of great, just as fire sets the straw alight more easily in thatched cottages than in palaces.

François Duc de La Rochefoucauld

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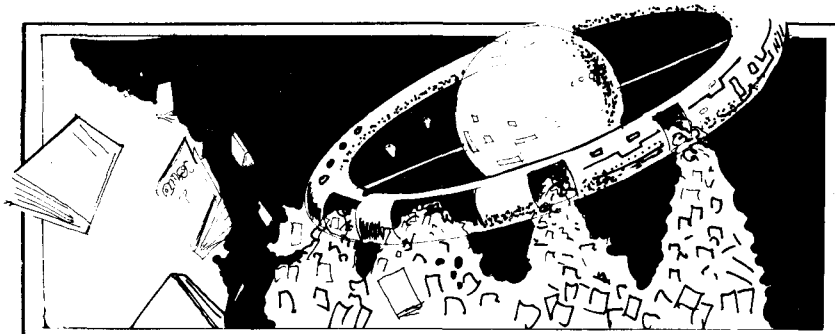

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EDEN REGAINED

F. M. Busby

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As much as the Godless liberal press loved to sneer at Creationism, calling it Fundamentalist claptrap, now the scoffers had to laugh out of the other sides of their fork-tongued mouths. For it was the Creationist Institute's own Reverend Doctor Hosea Barner, not any of the atheistic evolutionist "scientists," who developed the theory of time displacement and (with the help, both financial and technical, of other devout workers in the Lord's vineyards) brought it to fruition in the form of the Manned Past Probe.

Still on the sunny side of forty, Dr. Barner himself manned the Probe's first mission. And what better, what more sublime event to be visited, than the Crucifixion?

While the Probe's spatial coordinate settings proved accurate, unfortunately its temporal calibration was less precise. Dr. Barner arrived at Calvary some days after the Resurrection should have occurred; by then, various witnesses' stories had been repeated and relayed so many times that Barner's hastily conscripted interpreter of the Aramaic language finally shrugged and said, "They don't know what happened." Pause. "Some say one thing, some another." Cough. "Embroidered a lot, you know what I mean." Another shrug. "For sure, the tomb's empty."

So Barner reverted the Probe to *Mark: Present,* rather grudgingly paid off the taciturn Semite, and despite his lack of executive status, saw to the immediate convening of the Institute's board of directors.

As usual the board members, long on cash but short on divine inspiration, rubberstamped Dr. Barner's agenda. Events of great significance awaited the searching scrutiny now made possible by the Reverend Doctor's Probe; certainly it was his privilege to set priorities. Nodding and smiling, Board Chairman Isaiah Frommett entertained a motion to that effect, declared it passed, and adjourned the meeting.

For the next mission, one change was made. Dr. Barner being indisposed by nagging digestive disturbance ("I should have known better than to drink the water"), the Probe was manned by his protégé, the young, not-yet-Reverend Absalom Hightower.

Strong in faith but less so in other pertinent attributes, Hightower did not meet with rousing success. Perhaps Dr. Barner should not have sent a former second-round draft choice of the L.A. Lakers to cover the David-Goliath bout. Recounting the fiasco as he held an icebag to the angry-purple lump on his forehead, Absalom reported that on emerging from the Probe he had been greeted with shouts of "Goliath! Goliath!" Whereupon a man presumed to be David had loaded his sling, and "—the little guy sure has a mean beanball. Lucky I ducked partway."

Possibly due to quicker reflexes, the interpreter escaped injury. Nonetheless he declined further employment; future missions, therefore, would be restricted to observation.

Because Dr. Barner had a forgiving nature and no other volunteers, he gave his young assistant a second chance. Hightower arrived at the Tower of Babel all right, but immediately after the Lord

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had confounded the language of its builders, so that none could understand another. "I suppose," said Absalom, rubbing one shoulder with the hand that wasn't in a sling, "that's why the one guy bumped the other one who dropped the hod of bricks."

Barner displayed no loss of confidence—but mission after mission, results failed to improve. Nonetheless he decided to go for broke. "The Great Flood this time," he announced. "You will greet the Ark when it lands—this is before Babel, so you shouldn't have any language problem—and see all the creatures of land and air as they emerge, two by two. I'd especially appreciate it if you could get a good shot of the dodos." For on this and subsequent ventures, Absalom would take a camcorder.

But either the temporal calibration was still off or else Dr. Barner's calculations were; Absalom found himself in the Probe sitting squarely atop Mount Ararat, but under quite a depth of water. Since the Probe leaked, it was fortunate for him that he managed the time-reversion sequence with considerably less fumbling than usual.

Perhaps, thought Barner, they should practice on a few lesser events. Absalom Hightower visited Isaac Newton. When the apple dropped it hit the young man squarely on his head; the eminent scientist was so concerned for his guest that he didn't give a thought to gravity until Absalom, dimly realizing that something was going badly wrong, brought the subject up himself.

That one scared the Reverend Doctor. What if this new turn of past events changed history? He checked reference books, found no alterations, and heaved a sigh of relief. Thank the Lord, he thought, for ego: crusty Sir Isaac wasn't about to give a chance visitor any credit for *his* discovery!

With noticeably growing reluctance, Hightower undertook further missions. When Joshua's trumpet indubitably destablized Jericho's walls, the young man was standing too close and got beaned again. He wasn't sure whether the sun had stood still, earlier; maybe it just seemed that way because the Israelite leader's pre-battle pep talk went on interminably.

"And it wasn't as if I could understand a word of it."

Also, the camcorder was lost. Again Dr. Barner agonized: would the appearance of a modern artifact in ancient times skew development of the Hebrew culture? On further thought he decided not; like the majority of modern artifacts, the camcorder was mostly plastic. Not biodegradable, maybe, but certainly not sturdy. What fragments horses' hooves and stones failed to obliterate, the friction of shifting sands would manage.

Equally ambiguous was Absalom's report on the parting of the Red Sea. "I didn't get there until it was over," he said. "All I know is, there weren't any Israelites around, or Egyptian soldiers, either. But somebody had cut down a lot of trees."

Looking embarrassed, the young man cleared his throat. "You know how persuasive Moses was supposed to be. I wouldn't be surprised if he recruited the whole battalion to build a lot of rafts, and that's how they all left."

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Except, presumably, for stragglers who returned to tell Pharaoh a tall story by way of alibi.

Absalom confirmed, however, that Mohammed did indeed go to the mountain. "But we already knew that, didn't we?"

The doctor sighed. Young Hightower was no shirk, but he wasn't getting results. And Barner's digestion was definitely back on robust track. Time it was for the Probe's inventor to take the helm. Resume command. Get the job done.

Isaiah Frommett gave every sign of displeasure. Over more than a dozen expensive missions, the Manned Past Probe had brought no real evidence to support the teachings of the Gospel. Dr. Barner's initial grant from the Institute was nearly spent; what good reason, asked Chairman Frommett, could Barner give the board in support of renewing it?

Reverend or not, doctorate or no, Hosea Barner was up against it. Thinking quickly, he said, "Chairman Frommett. Until now we have merely been trying to affirm Scripture."

"With—" The chairman snorted. "—little success."

"True." Altogether too true. "But what if—" Breathing deeply and thinking fast, Barner plunged ahead. "What if Scripture were not only proved, but *im*proved? Implemented, so to speak."

"You mean—?"

"Yes." Having no idea what the chairman may have thought he meant, the doctor felt free to improvise. "What if I were to eliminate Original Sin in its entirety?"

Rife with erudite curlicues, Frommett's signature validated the grant-renewal check.

All previous Probe missions had emphasized the observer's blending into the visited milieu. Consequently, Dr. Barner carried two fig leaves. Real leaves weren't quite large enough—but the plastic ones, he felt, looked quite authentic.

At first sight the Garden didn't impress him: a dinky little valley full of clumps of healthy-looking small trees or perhaps large shrubs, the lot surrounded by rolling desert sands straight out of a French Foreign Legion holo. All of it backgrounded, in far unreachable distance, by fruited purple hills. Inspiration, Barner realized, is not necessarily Divine. Or even unique.

But where *was* everybody? Cautiously Dr. Barner skirted the groves, peering to see who or what might lurk therein.

Someone tapped his shoulder. Startled, he turned to see a squinting face unnervingly close to his own. It said, "I am Adam. Who might thou be, and what art thou doing here?"

Well. If this bristlebrowed low forehead truly belonged to the First Man, perhaps the evolutionists had a point. But that were blasphemy; Barner said, "I might be just looking around. Go thou and do likewise." And so it came to pass.

All right. Assuming that shambling creature, innocent of fig leaves or any other garb, was Adam, then where was Eve? Moving deeper into the wooded area the Revered Doctor Barner espied,

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ahead, a clearing. Brushing his way past low-hanging branches he entered the open space.

And stopped, transfixed by the tableau he viewed.

When reading Tarzan books in his youth, the Rev. Dr. had wondered how a species could consist of apelike males and utterly gorgeous females. Here, all the way back into Genesis, he found the same anomaly. Adam was, at best, first cousin to a knuckle-walker. Eve, if this leafless vision were indeed the Mother of Man, more nearly resembled the composite ideal displayed to pubescent America by the kind offices of holovision. Her skin, her eyes, her hair, her lips, her legs, her—

But in this clearing, Eve was not alone. No. Across the way, silhouetted against the slanting trunk of a gnarled and twisted fruit-bearing tree, lounged a sleek, striking figure.

Humanoid in general outline yet totally unhuman in detail, the creature drew Barner's attention. On the tall oval head, features were minimal: lidless eyes, lipless mouth, nostrils and earholes with no surrounding cartilage. Yet overall, the effect was not unpleasing.

Skin? Not exactly—and yet, no discernible scales, either. A surface hard and flexible, segmented and shiny, colored in delicate patterns of coral and ivory.

Limbs and extremities graceful but somehow alien. Too many fingers, or too few? Barner shook his head; it didn't matter.

Like the others, this thing wore no fig leaves. It didn't need them; its smoothly-segmented crotch could hardly offend the strictest censor. Barner nodded. Of course; snakes bore retractile genitalia.

Enough of reflecting; time to pay attention. The passage with Adam confirmed that at this time, long preceding Babel, the Lord had not yet confounded men's speech together. He himself, of course, was from a later time, but apparently the time frame governed. And it was on this hope, this basis, that Dr. Barner hadn't bothered looking for a new interpreter.

So he listened. And the serpent spake.

What it said didn't sound much like the Scriptures Hosea Barner knew. But the gist was much the same. "Be thou not foolish, daughter Eve. Aye, the Lord sayeth this fruit would harm thee—but that is only another of His everlasting thou-shalt-nots; thou knowest how He is. He doesn't *want* thee to elate thyself to a state of bliss. Believe in me; taste thee only this one fruit, and thou wilt fly like unto an angel."

Lower lip protruding adorably, Eve said, "That is what *thou* sayest. But the Lord—"

"Knoweth not what thou dost. One taste; how couldst thou be harmed by such a mite?"

"*Enough!*" Shouting the word, Hosea Barner realized he meant it two ways: she'd be harmed plenty, and the serpent should shut up. Now as woman and demon alike turned to stare at him, the Reverend Doctor wished he'd thought before shouting, for he hadn't the vaguest notion what to say next.

"And who might thou be?" Soft and indolent, the serpent's voice yet filled the clearing. "Hath He been playing with clay again, whilst I heeded not?"

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The thing's sheer power staggered Barner—but he wasn't about to succumb without a fight. His thoughts spun: did the serpent know the future, or not? *Let's find out*—now how did it go, in Genesis? "I am descended of first man and woman, by Seth, at later time by Noah, later still by—" When were Gentiles first mentioned? "By *Ishmael*." Maybe so, maybe not. "And by many who appear not in the accords of the Covenant."

Even to him it didn't ring true, but there wasn't *time* to get it right; full speed ahead. "So by their sanction and the power vested in me by the county of Claymore in the state of—" *Watch it, Hosea; this is not a wedding.* "I command thee, serpent: begone!"

Aside from stiffening slightly, the creature didn't move. Time to reload, but with what? "Aroint thee, Satan!" Barner had no idea what it meant, but he'd read it somewhere and it sounded good.

Reticulated brows creasing, the serpent leaned forward. "What didst thou name me? And to what vile act didst thou seek to commit me?" It shook its head. *"Aroint??"*

Frazzled, Barner shouted, "Leave the woman alone, damn you! And get your scaly ass out of here!" It wasn't really scaly, of course, but no better word came to mind.

Pushing off the tree trunk, the serpent stood taller than Barner expected. "Spawn of man, who art thou to challenge *me?*"

"I—"

But before Barner found whatever word he might have uttered next, Eve spake instead. "I tire of thee. Of thee both. Go forth from here, and approach me not again this day."

Silently, moving with exquisite economy, the serpent turned and left. Much less gracefully, Dr. Barner departed in the opposite direction. Once into cover, though, he paused and looked back—to see Eve briefly fondle a fruit hanging from the tree, then shake her lovely head. Her own exit, he noticed, was on a path nowhere near that taken by the serpent.

Hustling back to the Probe, Dr. Barner reverted it to *Mark: Present.* There (or rather, then) he fobbed off Chairman Frommett's questions and enlisted his aid in assembling a few supplies before returning to the Garden.

Arriving in mid-afternoon he waited until night before venturing to the clearing.

Chainsaw and gasoline made short work of the tree and all its fruits. With jaunty step, Hosea Barner went back to the Probe and activated its controls.

So much for Original Sin!

Now what had gone wrong with his calibrations? The dials read *Mark: Present*, and to the west, right there they belonged, lay the familiar foothills—but where was any sign of man or his works? Barner looked and squinted, rubbed his eyes and rechecked his Probe's instruments. Nothing helped; here he was, Probe and all, in untouched wilderness.

What could have gone wrong?

A horrid thought came. Maybe God had resented his interference, had sent him to a place—not Hell, but not exactly Heaven, either—all his own. To con-

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template the presumption implicit in his behavior. Maybe . . .

There was only one way to find out. Barner checked the Probe's power readings. Yes, the cells still carried enough charge for one more trip.

No reason to change his control settings. Barner punched for Past Penetration and prayed.

Most sincerely, did he pray.

Except for the tree, Eden was unchanged. In the central clearing, standing near the blackened space Barner's work had left, he found Eve and Adam: the woman pouting, the man looking more than a bit henpecked. Of the serpent, no sign.

Looking away from the man, Eve spotted Dr. Barner. "Thou! It is *thy* fault the Lord is vexed with us."

"Vexed? I don't understand."

Adam gestured. "The tree. We were not to touch it; the Lord sayeth we had no right—"

"And we did nothing." Tears welled in Eve's stunning eyes. "And the serpent surely would not. But *thou*—"

Trying to wave her to silence, Barner talked fast. "All right; I did it. To save you. I will—" He already had enough worries, but after all . . . "I will tell of your innocence."

"That is well." As a deep voice came from above, the sunlight dimmed; looking up, Barner saw a dark cloud shot with fitful, silent lightnings. *The Lord?* "Tell me who thou art, from whence thou comest, what thou hast done—and perforce, why?"

"But dost not—" The language was contagious. "—dost not Thou know *all?* I mean, we were always taught—"

Now the lightnings brightened; beginnings of thunder murmured. "I see. I had not thought to look so far thence. I must ponder." Again soft rumblings, then: "Adam, Eve; go thou to the stream below the spring. Wash from thyselves the dust and ash thou hast encountered here. Dry thyselves by the sun; at that place I shall not cover it. And be not soon in thy return."

When the two had gone the cloud spake further, saying the visitor's name and time, indicating surprise at Barner's being here, out of that time. But asking one question only.

"Why didst thou destroy the tree?"

"Because—well, Original Sin—Man's sorry lot—it seemed to me—" Coherence was beyond Barner now, but the cloud seemed to understand; its rumbles had the sound of acknowledgments. "And so, Lord, I wanted to avert the Fall of Man." He scowled. "But up at *Mark: Present*—my own time—Man seemed to have disappeared completely. Why—?"

"Not so. The Garden was—will be—here still. And Adam with his Eve, chaste and unaging for all Eternity."

Oh my God! Well, maybe it wasn't blasphemy if you didn't say it out loud. "Then the human race—?"

"As thou knew it, will never exist."

"But I—how am *I* still here?"

"Hadst thou gotten out from thy device, in that time wherein thou hast no longer any place, thou too would have become nothingness. Only here, in this world now changed from its very beginnings, canst thou endure."

"Stay here? But what will I *do?*"

"Thou may guard this place. That

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were the serpent's responsibility, but he failed; he betrayed it. And so I have driven him forth to find his station amongst the beasts."

"Crawling on his belly, You mean?"

An interrogative rumble. "Why should I wish to shame him further?"

Definitely a new timeline! The cloud began to dissipate; the voice softened, fading. "If thou hast questions, call upon Me. But bide here a time, learning, before thou dost so."

Then the cloud was gone.

Also gone, when Barner went looking, was the Manned Past Probe. Either the Lord wasn't taking any chances or He simply didn't care for anachronisms lying around.

Some of the departed anachronisms, in Barner's personal kit which he wished he'd carried with him, he was going to miss. For one thing, not too long from now he'd be looking like a Biblical prophet—or a 1960s hippie, but all things considered, the former image seemed more appropriate.

Many other conveniences wouldn't be around either: gourmet foods, the wines he probably shouldn't enjoy but did anyway, his favorite holovision shows. . . .

Depressed, he dropped that line of thought. What *would* there be? An apparently equable climate, fresh clean water, fruits and veggies in ample supply—would the Lord countenance the snaring of small animals as a dietary supplement? Assuming Barner could dredge up enough boy scout lore to make fire. . . .

Then the item of companionship. When it came to stimulating conversation, Adam was certainly no great shakes. And Eve, definitely given to pouting; Barner was rather sorry the Lord had fired the serpent.

Eve, though. To Barner's eye a gleam came. In the bad old days before he found his faith and was reborn, Hosea Barner had been a bit of a devil, so to speak, with the ladies.

Now that he thought about it, he'd never needed any oddball apples, either.

It wasn't much of a gene pool. But if there were any truth to the books of the Apocrypha, the Lord would provide. ■

●The director of Military Aeronautics of France has decided to discontinue the purchase of monoplanes, their place to be filled entirely by bi-planes. This decision practically sounds the death knell of the monoplane as a military investment.

Scientific American, September 1915

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The Alternate View

THE KISS OF DEATH

G. Harry Stine

Several years ago, I purchased a portable voice-actuated cassette tape recorder to carry along in my airplane and record my air-to-ground radio communications with air traffic controllers. I deemed this a necessary action in view of the fact that the Federal Aviation Administration had started to bust general aviation pilots such as myself for the slightest infraction of the many, complex, and often incomprehensible rules. I was doing a lot of flying in and out of places such as the Los Angeles basin, Las Vegas, St. Louis, and even as far away as New York City and Washington. Therefore, I wanted to have all my clearances on tape J.I.C. (Just In Case). Turned out that I didn't need to do it because I was being extra-careful anyway. However, I still record radio communications even though we are now being told that the present-day FAA is a kinder, gentler bureaucracy. (Believe that, and I've got some land in northern Arizona I'd like to chat with you about. . . .)

To make sure the batteries were always topped before a flight, I sprung for the model with nickel-cadmium cells and a charger.

I was introduced to nickel-cadmium batteries nearly 30 years ago by the venerable John W. Campbell, Jr., former editor of this magazine and an electronics amateur *par excellence*. "Keep ni-cads on a trickle charge that is ten percent of the full charge rate, and they'll last for years," Campbell instructed me. I'd done this with a lot of ni-cad cells and had very good results with battery life.

However, the instructions told me not to allow the ni-cad battery pack to completely discharge in order to extend battery life (a good idea which I'd learned was The Truth), but it also did not recommend a constant trickle-charge when the recorder wasn't in use.

What was I supposed to do?

I bought the battery charging module that was sold as an accessory, just as the ni-cad battery pack was. And I charged the battery pack up to full charge after every use. Ni-cads will hold a full charge for a long time because they have such a low self-discharge rate.

But modern ni-cad battery and charger technology had apparently changed something. I discovered that I had to replace the battery pack every few months when the cells would not accept or hold a charge.

This was getting expensive, because replacing the ni-cad battery pack amounted to 25% of the cost of the cassette recorder!

So I said to hell with high technology and ripped the ni-cad battery pack out. I replaced it with ordinary non-rechargeable alkaline batteries. Turns out they

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not only cost less—a *lot* less—but they run the recorder longer before they go flat. If I need to be absolutely, positively certain that the recorder will run for a long time, I just put in a new set of alkaline cells from the box of them that I bought (at a fraction of the cost of a new ni-cad battery pack) and keep in the refrigerator.

Out of curiosity, and because I no longer needed it, I opened up the sealed ni-cad battery charger to see what was inside. It was a high-tech zoo. A couple of integrated circuit chips and some discrete silicon units. After probing around the circuit, I discovered that something had crapped out, and the circuit wasn't putting out the sort of current necessary to keep the ni-cads charged. But there was no way to determine this without tearing the charger apart. High tech had failed with no fail-safe or quit-light.

Years ago, I built the same sort of thing in about the same size box using good old transformers, bridge rectifiers, a couple of capacitors, a transistor, and a zener along with assorted resistors; I installed a couple of LEDs which, when lit, told me my low tech charger was working as I had designed it to work. My home-built unit has never failed me. I still use it today to charge the batteries for launching my model rockets.

I suspect that all of you have had similar experiences with overly-complex products that have been designed with modern high technology when good, old low technology would have done the job just as well and perhaps even at a lower cost.

I have trouble forgiving the engineers, marketing managers, and company executives who fall prey to a Rube Goldberg type of mentality that foists such high tech monstrosities on their customers. I have a little list. I keep track of these outfits who are so beholden to high tech. It's my "KISS of death" list.

"KISS," of course, is an acronym for "Keep It Simple, Stupid."

We tend to revile and snicker at those poor, misguided, obsolete souls who continue to use low technology in their gadgets. The Soviet Union's engineers are experts at effectively using low technology to produce high technology results. In the first place, they do not have the abundance of high tech OEM products available to engineers in the Marketing Economies. They must make do. Furthermore, their gear has to continue to work in some very rough environments. Moscow, for example, is as far north as Labrador and even their space launch facilities at Tyuratam are as far north as Ottawa. The Soviet helicopter designer, Mikail Mil, pounds the following philosophy into his engineers: "Make it simple. Make it strong. Make it rugged. Make it work."

Western military observers claim the Soviet military equipment won't work well for extended periods of hard use in a combat environment. But the Soviets have a different philosophy. For example, their aircraft are designed for a service life of about 150 hours flying time. When an airplane reaches that point, whether it's working fine or not, it is pulled from service and a replacement is brought up from a reserve of rebuilt airplanes. If an airplane has something go wrong with it that can't

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be fixed by a drafted peasant using a screwdriver, it's also pulled from service. The "worn out" airplane is sent back to the *Tyl* or rear area and then to a factory where it is *completely rebuilt*! The aircraft, once rebuilt front to back, is put into ready reserve storage. Thus a Soviet squadron commander knows that every airplane in his inventory is effectively a combat-ready new airplane.

If the Soviets ever manage to overcome their massive inferiority complex coupled with a national paranoia, and if they begin to produce and export consumer goods built like they build military equipment, some of the "throw-away" products of the West are going to be in deep trouble. Don't say it can't happen. Remember when "Made in Japan" meant cheap, shoddy goods?

There is much to be said for the low tech, simple, KISS approach.

I mentioned model rockets earlier. Yes, I still fly them and enjoy doing so. Every model rocket flight is a new experience, and no two flights are alike. I use an electrical firing system I built in 1961. It consists of a very rugged aluminum box in which are good and simple components—a quality sealed socket and bulb as a continuity light, a very rugged DPDT momentary-contact toggle switch designed for rough military use, a key-operated safety switch that's an ignition switch for a truck, heavy duty rubber-insulated (not plastic) #14 AWG aircraft-type wires carefully soldered to all connections, and a 12-volt rechargeable gel cell. I've replaced the battery seven times over the years. I rarely have an ignition failure. It's a KISS design. It works over and over again, and I can count on it.

I try to impress the KISS principle on other members of the rocket club, and I always meet with resistance at first. However, the super-fancy solid-state electrical ignition systems with built-in count-down timers and audio beepers and capacitor discharge sometimes work and sometimes don't. Usually the latter. Eventually, the techies who built them catch on and rip out the high tech to install electromechanical relays or plain old toggle switches.

High technology is a Lorelei singing an enchanting song; it can lead one easily onto the rocks and shoals of unreliability or flat-out failure. The few examples I've given here are just that: examples. We see this situation in all sorts of products—electronics, automobiles, household appliances, power lawn mowers, personal computers, computer networks large and small, and even jet airliners. Do not ask or wonder why our space program's equipment is expensive, non-functional, and usually inoperable; NASA forgot the KISS principle more than a quarter of a century ago. NASA isn't alone but happens to be a glaring example that is easy to point to. This caution applies equally well to modern high tech organizations with their high tech on-line management systems, their market analyses crunched on data bases, and their wall-to-wall financial projections using huge spread sheets. The US government and most very large multi-national corporations have, they believe, passed beyond the KISS stage. As a result, the critical datum that can tell them where they've been, what

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they're doing, and where they ought to be going is usually buried beneath a pile of complexity.

Technology has a way of rendering all of us awe-struck. However, it's important to remember a basic and unchanging truth about technology:

If you want to avoid building or buying or operating a lemon—remember the KISS of Death. ■

●Unlike all of the industrial revolutions that preceded it, molecular engineering requires, as an essential component, the ability to design, model, and simulate molecular structures using computers.

Computer aided design has been largely an adjunct to engineering so far. It has promised productivity gains, cost savings, and other benefits but except at the leading edge, as in VLSI design, has rarely been an indispensable component of the design process.

But with molecules, if you can't model it, you can't build it. Computer aided molecular design is one of the key enabling technologies of these imminent industrial revolutions, and stands to benefit both by helping to bring them about, and to profit from the fruits of their success.

A computer aided design company that comprehends, throughout the organization, what is about to happen and takes the small, cautious, prudent steps today to position itself to ride this next wave, stands an excellent chance of emerging as one of the dominant industries on the planet as molecular engineering supplants our present technological base to the degree that integrated circuits have replaced vacuum tubes and electricity has displaced steam engines.

John Walker

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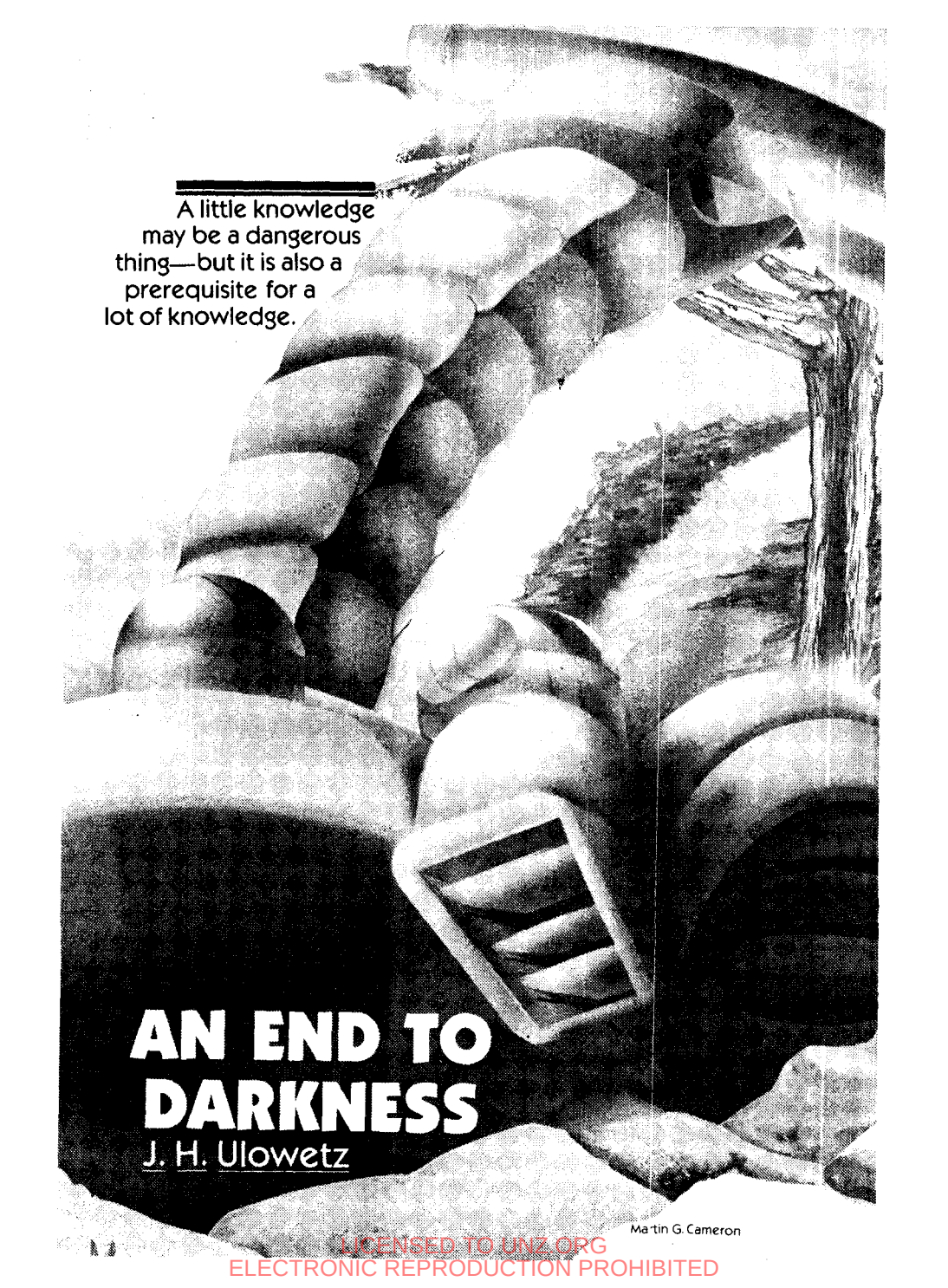

A little knowledge may be a dangerous thing—but it is also a prerequisite for a lot of knowledge.

AN END TO DARKNESS

J. H. Ulowetz

Martin G. Cameron

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Klei gripped his sword tightly as he crouched behind the fallen makia log. His heart sank as his red hair fluttered in the gentle breeze. So much for hiding until the Zorn moved away, he thought. The safety of Prince Tiamol's castle was just on the other side of this hill, but it might as well be on the distant moon Icespeck for all the good it would do right now.

Twice in the past hour, the Zorn had moved past his hiding place. Once it had come so close that he could see the grease in its huge gears as it searched for him.

Klei tried to console himself with the fact that encounters with Zorns were rare; they were usually more interested in small rodents or brightly colored birds than in people. But sometimes, he knew, something about a person caught their fancy. Then they would pursue that person until they either caught and dismembered him, or lost his trail.

Only they never lost a trail.

As long as there was no wind, he hoped that the aroma from the decaying makia log would mask him from the Zorn's legendary sense of smell. But now that the wind was dispersing the fragrance, the Zorn would smell him as surely as a kimbat can sniff out a ripe rose-apple.

Keeping low to the ground, Klei climbed over the soft yellow log and moved quietly downwind. If the Zorn was in that direction, there was no hope for him anyway. And if it wasn't, this would buy him some time. He had his sword with him of course, as would anyone traveling outside the village. While the sword would protect him from wild pigs or the occasional awkling, it wouldn't offer much hope against a monster like a Zorn.

A dry branch snapped under his leather boot. He immediately heard the sound of bushes being uprooted several dozen yards to his right. Glancing in that direction, he spotted sunlight glistening off bright metal. He saw the four huge wheels and numerous gears on a boxlike body that now turned toward him; its several metal arms thrashed the air.

Grampa said that Zorns couldn't move fast on steep slopes; Klei hoped it was true. He ran toward a steep section of the hill above the river gorge and started making his way across the face of a rough boulder. The rumbling of the Zorn became more intense as it labored to follow.

His sword was still in his right hand as he reached for a ledge with his left. The ground was almost vertical here, with only a steep drop to the gorge. When he shifted his weight, the moss under his boot gave way. He fought for balance and reached for the ledge with his right hand, forgetting his sword for an instant. It struck the rock and pushed him outward.

As he rolled over the edge of the gorge, he wondered if the Zorn would still be interested in his body when he reached the bottom.

High Priest Gildwin, chief advisor to Prince Tiamol, leaned back from the Terminal and swore to himself. Another innocent villager killed! He had seen the entire incident, right up to the point where the red-headed young man had

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fallen to his death. He had seen it all in the brilliant holovision transmitted by the Zorn.

And he could do nothing to prevent it. Neither his greatest spell, nor the entire militia of the castle, could stop a Zorn once it had decided on its target.

Damn his ignorance. If he only knew the proper incantations, he was sure he could free the land from those mechanical menaces. But such knowledge had been lost in ages past. Only fragments of the mighty magic remained.

Clearing his throat, he pressed the one control he knew and carefully spoke a spell: "Holographic transceiver off." The glowing image in front of him vanished.

Confident that he had performed the incantation correctly, he left the small chamber and closed the heavy wooden door that guarded one of the priceless Relics of ages past. He secured a large padlock on the door, partly to protect the Relic but also to protect the inhabitants of the castle from the effects of curious hands.

The story was still told of High Priest Saarland and his experiments with the Terminal in Makeridge Castle. He had been using it to try to locate the famous Relic called the *Sceptre*. He actually thought that he would be able to master that Relic's great power and use it to reestablish contact with the legendary Ancestors.

Exactly what he did that day over a hundred years ago was never known, nor did anyone want to find out. Somehow a Zorn was summoned and it attacked the castle. Anyone doubting the validity of the story needed only to visit the site of Makeridge. That same Zorn continued its destruction to the present, turning the few remaining pebbles into dust.

The high priest shuddered from the thought of Makeridge, and headed toward the audience hall to inform the prince about the sad death of the villager.

He didn't know the young man's name, but he was sure it would be easy to find out. There couldn't be more than one or two red-headed people in the entire principality.

Klei felt an overwhelming sense of blueness as he struggled to consciousness. The blueness resolved itself into sky. He was on his back looking up; around him were the branches of the bush he had landed on.

"I'm alive," he whispered. "Praise be the Ancestors." He had several deep scratches and had blacked out from the force of impact, but nothing seemed to be broken. He sat up and glanced down through the limbs of the bush. Twenty yards of sheer cliff separated him from the jagged rocks on the shore of the river.

Looking around, he saw that the bush grew out of the side of the gorge. He doubted that even a Zorn could reach him here. Nor, for that matter, would anyone else. No one had been around to see him fall. And no one would think to look for him here when he was supposed to be in the forest picking wild mushrooms for his mother. It was just bad luck that the Zorn was roaming these hills today and took an interest in him.

The cliff rose at least another twenty yards above him, and it looked as im-

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possible to climb as the section below. He carried no rope; who needed rope to pick mushrooms? He had even lost his sword during the fall. Diving into the river wasn't an option; the plunge into the rapids would probably kill him, and he couldn't swim anyway.

The sound of metal scraping stone from above attracted his attention. A flash of sunlight confirmed his fear: the Zorn was still after him. But so what? It couldn't reach him here. Let it fume. It might even attract attention to his plight.

The sound above seemed to be getting closer. He knew that was impossible; he would easily spot its enormous bulk if it started to climb down toward him. But the sound continued to come closer, and he could now make out its source: a metal snake weaving its way down the side of the cliff. All he could see was its front end, but that was quite enough for him to identify it as one of the Zorn's metal arms.

Klei climbed along the stiff prickly branches of the bush to seek shelter on the cliff. He needed a weapon, something to defend himself with. Looking around, he selected a hand-sized bump in the cliff face that appeared loose. Careful not to lose his footing he pried it away.

"I'm not giving up without a fight," he said, but not very loudly. The rock felt odd in his hand, and he glanced down at it. He realized that the object in his hand was a brick.

In his surprise he almost dropped it. How could this have gotten here? He looked back and saw darkness in the spot from which he had pried the brick. He now noticed the regular pattern of an old brick wall covered this part of the cliff.

He dropped the first brick and started pulling others away, tossing them into the river. Ancient mortar crumbled to dust as he worked to widen the opening. There was definitely a cave behind the wall.

He felt an intense pain in his left shoulder. In his excitement at the discovery of the cave, he had forgotten to keep an eye on the Zorn. A tube of flexible metal two inches in diameter ran from his shoulder up the side of the cliff. Three curved needle-like pincers attached to a black band near the end of the tube dug into his shoulder. The snake's pointed snout began to vibrate and burrow into his flesh.

He swung the brick in his right hand and struck the snake. The force of the blow dislodged it, further slicing his already injured shoulder as the pincers tore loose. But the snake retained a grasp on his shirt and began to draw in the fabric, pulling his body back into contact.

"Have a brick," he shouted and shoved one into the teeth. The teeth slowed but began to grind it away. During the brief respite, he writhed out of his shirt. Scrambling up through the hole he had created, he fell inside.

High Priest Gildwin coughed loudly to conceal the noise made by his amulet. Prince Tiamol cast him a foul glance and continued with his speech to the visiting dignitaries. The amulets were the prized secret of the clergy; the high priest doubted that even the prince knew of the Relic in other than vague terms. The high priest wished yet again that his

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amulet was like that of Abbot Thomasly, which only vibrated instead of buzzing like an insect. The two amulets appeared identical except for the placement of a small stud, but the high priest would sooner throw himself before a Zorn than risk the destruction of a Relic by experimenting with one.

Buzzing twice in one day was highly unusual for the amulet. He would have to wait for the official ceremonies to conclude before he could return to the Terminal. The first time he had been summoned today and chanted the Query spell, he had witnessed the death of that villager. He hoped that the Zorn had not turned on someone else so soon. Perhaps the Terminal had simply detected another rat in the dungeon under the castle. He sincerely hoped that was all it was.

The floor beneath Klei was as smooth as polished slate. Through the opening in the wall, he could see the metal snake flailing around blindly as it searched for him.

His eyes had not yet adapted to the darkness inside the cave so he could only make out vague shapes. He wanted to scream from the pain in his shoulder, but the menace outside the wall kept him silent. If he had thought to toss some of the bricks inside instead of into the river, he would have been able to use them as weapons now.

The snake chanced upon the opening and began working its way inside. Its teeth were grinding as if in expectation of resuming their interrupted meal.

As Klei crawled backwards from the snake, trying to keep his weight off his left shoulder, his hand came upon a wooden post. Feeling about, he identified a smooth rope wound around a spindle with a crank attached to it, all within a heavy wooden tripod. It was a hoist, like the one in the village. Maybe it was used to lift material from the river, he thought. The glimmer of an idea began to grow in his mind.

Checking that the tripod was firmly attached to the ground, he played out a few yards of rope and tossed them in the direction of the snake. Now all would depend on how stubborn it was.

Whipping the rope about, he brushed the head of the snake. It reacted quickly and grabbed hold. Klei engaged the crank and began to wind in the slack. When only a little remained, he looped the rope around the head of the snake, behind the pincers, and then cranked with all his might.

Grampa had always warned him to be careful of grabbing a *tie-ger* by the tail. He had no idea what a *tie-ger* was, and suspected that Grampa didn't either, but the warning seemed very appropriate to this situation.

The snake squirmed as it tried to free itself from the rope. He wondered if he could trap the snake by wrapping it completely around the wheel. He continued cranking the handle while standing as far away as possible.

The snake struggled desperately for a few moments, then suddenly went slack. Klei jumped back for fear it was getting loose.

A shadow flew past the opening in the wall.

Suddenly, the snake snapped taut again and the tripod was ripped from the floor. It hit the brick wall with a terrific din.

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When the air cleared of dust, he saw that the hoist and the snake were gone, and so was a large section of the wall. Wiping dirt from his eyes, he looked out from the now enlarged opening. The steaming remains of the Zorn lay in the river.

"What have I done?" he whispered. No one had ever as much as damaged a Zorn before, and this one appeared quite dead. But in the end, it had extracted its own revenge on Klei: he had several cuts and scrapes from his fall, he was bleeding from a gash in his shoulder, and the rope and hoist were gone. And without the rope he had no way to escape the cave.

High Priest Gildwin was trying to pay attention to the award ceremony for the Seamstresses Guild. Their outstanding work on the new quilt for the royal bed was being recognized by the prince. But the high priest found this very difficult as he coughed to cover up the buzzing sound of his amulet. It had just started up for the second time today since the death of the villager. He *must* return to the Terminal to discover what was going on.

Prince Tiamol had paused in the presentation and looked directly at the high priest.

"Begging Your Highness' pardon," he coughed, and then coughed again. The damned amulet wouldn't shut up. It usually fell silent after a few seconds, but this time it kept on buzzing.

"You are dismissed, Your Eminence," the prince told him with an annoyed look. With that, High Priest Gildwin coughed his way out of the audience hall.

* * *

Standing at the opening in the wall, Klei felt blood running down his left arm. Dealing with his most immediate problem, he sat down and ripped several strips of cloth from his pants. Pressing the makeshift bandage to his shoulder, he exhausted every oath he knew and started down the list a second time.

The flow of blood from his shoulder finally stopped and he secured the bandage in place. Standing, his vision dimmed momentarily as dizziness threatened to overcome him. He had lost a dangerous amount of blood and he knew he needed to get help soon.

He walked around the cave to see if there was anything he could use. With the light from the enlarged opening, he could see that the cave was square with polished, featureless walls. Now that the hoist was gone, it was empty. But in the rear wall was a passageway that extended into the darkness.

Having no other options, he walked into the passageway and placed his hand on the wall to guide him into the gloom. At once a globe of light began to shine from the ceiling above him.

"Ancestors preserve me!" he prayed as he threw himself prone on the rough stone. He placed his hands over his eyes in the sign of reverence that the priests had taught him. "I am a sinner on holy ground. Have mercy on me for trespassing in this sacred place!"

He quivered with his eyes shut tight, awaiting the bolt of lightning that would end his life.

Nothing happened.

After a few silent, trembling minutes he opened one eye and looked between

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his fingers. The empty passageway was ahead of him, lit by the globe above.

The other eye opened cautiously. He still didn't die. He lifted his hands away from his face and glanced up at the globe. It was bright, but showed no interest in him.

He sat up and pain from his shoulder lanced through him.

"Well, I guess I'm not dead," he gasped. Struggling to get his feet under him, he stood with difficulty.

He thought for a few moments, and decided that the passageway was still the only direction available to him. With the implied consent of the Ancestors, he began walking.

Once clear of the audience chamber, High Priest Gildwin increased his pace but tried to keep to what he thought was a dignified stroll. The amulet had chosen that moment to quiet down, so he could stop his forced cough. As he proceeded down the west wing of the castle, he slid his right hand under his robes to touch the amulet for reassurance, as was his habit when troubled. But before closing his fingers about its smooth oval shape, he suddenly realized that his palm was sweaty from anxiety and jerked his hand away. In recent years, the amulet had seemed to develop an aversion to being touched by moisture and would often strike out in a toothless bite that left burn marks and was exceedingly painful.

Smoothing down his robe, he tried to keep worry from showing on his face as he entered the chapel wing of the castle and went to the door of the Terminal chamber. He removed the key ring with its solitary rectangular key from his pouch. Inserting it into the padlock, there was a small, high-pitched tone and the lock parted. He entered the chamber, closing and bolting the door behind him.

Pausing to slow his breathing, the high priest ran through the preliminary prayers. Once he had satisfied the ritual, he pressed the command stud and spoke the first part of the spell: "Display status."

A screen of symbols appeared before him. The symbols meant nothing to him, but the spell must be cast in the prescribed order.

He again pressed the command stud and spoke the next part of the spell: "Verbal summary." The high priest then dropped to his knees and bowed his head.

From the Terminal, the Voice spoke: "Zero eight twelve zulu, Zoology Research Probe five, target reacquired for anthropological research subprogram. Warning: dissection directive overrides human safety guidelines until reset.

"Zero eight fifteen zulu, level fourteen, air flow disturbance detected at access portal five.

"Zero eight twenty-two zulu, Zoology Research Probe five, manipulator arm trapped. Corrective routine running.

"Zero eight twenty-three zulu, Zoology Research Probe five, loss of traction in number two and number three drive units. Self-preservation rule preempts all current tasks.

"Zero eight twenty-four zulu, emergency, Zoology Research Probe five, communications lost.

"Zero eight thirty-one zulu, level fourteen, power activated.

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"Do you wish hardcopy?"

The high priest rose and pressed the command stud; he spoke the last part of the spell: "Negative." Only then did he raise his head from the posture of respect and move to his writing table.

The greatest theologians could only guess at the full meanings of the revelations from the Voice of the Ancestors. The best he could do was to write down the Words as well as he could remember them for future studies that might broaden their meager knowledge. He sometimes wished he had a scribe present at such times. But use of the Terminal was allowed only to those with twenty years of careful study, so the presence of a mere scribe could never be tolerated.

After making his notes, he opened the Tome of Guidance, which had been authored by centuries of theologians, and began to decipher what he could of the message.

He already knew that "*Zoology Research Probe*" referred to a Zorn, but what was a "*manipulator-arm*," and what was the significance of a "*communi-casion*" and how could it be lost?

He found one of the phrases referenced: "*power activated*." As he read the learned words, he eyes grew wide with rage. He leapt up and rushed from the room, yelling for guards.

It was the first time in twenty years that he had failed to genuflect on his way out of the Terminal Chamber.

The passageway was illuminated by additional globes on the ceiling. At first, Klei would carefully approach each globe and kneel down, wondering if this would be the time he would receive his punishment for trespassing on holy ground. Holy ground it must be: he had seen such a globe once in the temple on his sixteenth birthday during the Ceremony of Attainment. The priest had explained that the globe was a Relic of great power. Although dark at the time, if its anger was aroused, it would emit a terrible light that would burn the flesh from men's bones.

After passing the fifth globe without perishing, he decided that kneeling might not be necessary. There had been no sign of punishment, and besides, the struggle to stand up again each time was increasingly difficult. He limited himself to making the sign of reverence as he passed the globes from then on.

He continued trudging down the featureless passageway, wishing desperately for just one cup of river water to satisfy his thirst. The loss of blood had made him lightheaded, his numerous cuts were a constant torment, and every step sent waves of pain through his shoulder.

In his misery he thought of Grampa. He remembered the fun they had when he was young. He had sat in Grampa's lap for hours on end, listening to stories. The stories were always about mysterious things like Relics. He wasn't sure that he believed many of the stories, but they sure were fun to listen to. Grampa had claimed to be the illegitimate son of a high priest—Saarland was the name if he remembered correctly—and that Klei's great-grandfather had discovered many interesting secrets about the Relics.

As a ten-year-old, he had been dying to learn those wonderful secrets, but Grampa was always mysterious and said something like "the *geens* would tell,"

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whatever that meant. He had tried to explain that it had something to do with parents and hair color and the like.

"You mean why I have red hair and other people don't," Klei had asked.

"That's right," Grampa had said. "Very few people have red hair; I did when I was younger, and so did my dad. He told me that there used to be a certain kind of people who could use the Relics real good, those with what he called a *designed ability*, and that you could tell who they were because they had bright red hair, just like you."

"I don't want to use no Relics. I don't want to burn up!" And he had started to cry.

"There, there, Klei-kins," cooed Grampa. "No one is going to make you use a Relic. But the Relics aren't bad. My dad said that they were just tools, and that the priests have forgotten how to use them properly. They can do lots of good things for people."

Klei moaned, "But can they make the pain go away in my shoulder?"

"Yes. Place both of your hands on the wall to your left."

"Sure, Grampa," Klei replied through a haze of agony as he tried to concentrate on the wall.

"Now turn your hands so that they point away from each other."

As Klei did so, the wall between his hands split silently and slid apart, revealing a lit room. There seemed to be several tables with things on them, but he couldn't focus his eyes well enough to make out the contents.

"Go to the back table. Pick up the grey box with the yellow cylinder coming out of one side."

Klei stumbled into the room and made his way to a table. There was only one object on the table, so he picked it up.

"That's right. Now rotate the cylinder to the right one quarter turn. Place the flat side of the box against your left shoulder."

Klei sniffled and said, "It'll hurt!"

"No, it won't. The neuron inhibitor is active."

"The what? I don't understand, Grampa."

"Never mind. Just do it. Now."

Klei clenched his teeth and placed the box against his shoulder. The box began to vibrate gently. After a few moments the anguish dulled to a tolerable level. With his mind released from the pain he could now see clearly.

Replacing the box on the table, he turned and said, "That's great, Grampa. But how . . ."

He was alone in the room.

He had never actually seen anyone with him.

And his grandfather had died eight years ago.

His mind wheeled in confusion. What was going on? He looked around and realized that he was in a room full of Relics. Glancing at the table before him, he saw the boxlike Relic and jumped back. He had compounded his sins by touching a sacred Relic with his unclean hands. Quickly he covered his eyes in the sign of reverence; he would surely be punished now.

When nothing happened after a minute, he shifted his left hand to cover both his eyes, and used his right hand to gently probe his shoulder. The spot was tender, but the pain was fading rapidly. He peeked from under his hand and lifted the bandage. Scar tissue had

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already started to form. He felt hungry, but there was no time for that.

He lowered his hands. Who had been talking to him? A flicker of blue light drew his attention to a pedestal in the center of the room. On it was an upright rod about a yard long. Decorating it were colored points of light that glittered like jewels. Legend spoke of such a Relic; it was called the *Sceptre*. It began to glow in a steady blue light that held his gaze.

He had the urge to cover his eyes again, but resisted. He should have been terrified, but instead he felt calm. He decided he was tired of always being afraid.

Tools, his Grampa had called them. To be used with knowledge and determination, not with fear. And this tool was calling to him.

"Whatever you want of me," Klei whispered, "I'll try."

High Priest Gildwin led the squad of militia down into the dungeon beneath the castle. Holy water had been administered to all the men, and the benediction chanted. Sword in one hand, torch in the other: they were ready for action, although their reluctance to enter the hallowed realm showed clearly on their faces.

The high priest still seethed with anger and fear. How dare someone trespass within the holy passageways. Didn't the fool know the dangers the Relics could pose?

They descended flight after flight of rough hewn steps until they arrived at the appropriate level. The high priest warned the soldiers not to touch the walls and then checked his ancient map. He led the squad down a dark passageway.

After marching a few minutes, Gildwin saw light pouring from a gap in the wall ahead. As he reached it, he motioned the soldiers to stay back. "Do not approach lest the holy light sear your souls!" The men looked even more nervous than before and came no closer.

Within the chamber, the high priest saw a battered young man in bloody rags. He was bathed in blue light from a rodlike Relic on a pedestal. The Sceptre, Gildwin realized. So it wasn't just a legend. He would have to be careful removing the intruder since Relics could be quite unpredictable when active like this.

The young man was saying something. The high priest moved into the room to hear.

"A line . . . a square . . . a cube. No, no, it has too many sides. *Noooo!*"

A wave of dizziness swept the high priest. It was as if he saw the intruder and the Sceptre from several different angles at once. The images then suddenly folded together and vanished into blackness.

A clap of thunder shook him as a great wind picked him up and threw him across the chamber. The far wall caught him and he fell in a heap on the floor. As he faded from consciousness, he cursed himself for his curiosity.

When he came to, the soldiers were carrying him on a litter up the steps from the dungeon. "Put me down," he commanded. "This is not how a high priest should travel."

Shaking his head to clear it, he remembered what had just happened. *What a terrible loss, the destruction of*

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a Relic! And the poor man; too bad he had to die like that, even if he had been trespassing. Gildwin couldn't bear to think about it right now. Limping up the few remaining steps, he arrived at the main floor of the castle. His personal assistant Deacon Margalis had been waiting and immediately came forward.

"Eminence, we have just received a report that a Zorn has been destroyed!"

"Why today?" the High Priest moaned.

"A villager named Jud found the body of a Zorn in the river while he was fishing. I assumed you would wish to speak with him, so he is waiting in your study, Your Eminence."

Resigned to his duties, Gildwin motioned the deacon to assist him as they walked toward the chapel wing. As they approached his study, he could hear violent coughing. Inside, he found the villager Jud curled up in a pool of bloody vomit on the foor and in obvious pain. His skin was ghostly white.

Trying to forget his own injuries, Gildwin limped to the villager. "Why didn't you tell me he was so sick?" he asked over his shoulder to the deacon.

"Eminence, he wasn't when I left. His skin was pale, but there was nothing like this!"

"Get my incense, quickly." The high priest began to sweat and fumbled to pull the flask of holy water out of his pouch. He said a quick blessing and then began to sprinkle the water on Jud. He feared he knew the disease. The ancient tomes spoke of it: *radiation.*

A knock on the open door made him jump. A page bowed briefly and began, "His Highness requests your immediate presence—"

"OUT!" the High Priest screamed. "Keep away! There is a terrible disease here. Tell the prince that no one may have contact with us."

The page, now looking almost as pale as Jud, stumbled backward a few steps. Then he turned and ran for his life.

The deacon, holding the lit incense, cleared his throat and asked in a squeaky voice, "Eminence, are we going to die?"

"I don't know. This disease is beyond my skill. Help me make him more comfortable."

They picked up Jud and laid him on a bench. The deacon then swung the censer over the dying man, chanting the standard prayers for healing. The high priest sprinkled more holy water and racked his brain for a spell that might do some good.

"I believe that I can cure him, Your Highness." The unfamiliar voice came from outside the open door. Turning, the High Priest saw Prince Tiamol and, with him, a young, red-headed villager.

"Your Highness, stay back! There is a terrible disease here."

"We are aware of that, Your Eminence," the prince replied evenly. "We wish to test the claims of this person here."

The high priest started as he recognized the intruder from the dungeon, and then realized that the young man held the Sceptre. "Your Highness, this is sacrilege," he cried out, forgetting about the disease. "That Relic must be placed in my care at once."

The young man flinched and appeared very uncomfortable, but stood still.

"Gildwin," the prince said, "this is

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an issue of state and we will deal with it ourselves." The prince turned to the young man next to him. "Go to him, boy. We will watch from here."

Klei entered the room and cautiously walked over next to the high priest. It was hard to resist the urge to genuflect or make the sign of reverence before the high priest; but if he showed weakness now, he would never be able to complete his mission. Taking a deep breath, he extended the Sceptre over Jud and closed his eyes. "What should I do?" he whispered.

"Turn me parallel to the patient. Now imagine that you can see the inside of his body. What do you see?"

"There are some tiny yellow specks in his lungs and on his face and hands. There is also an orange glow coming from my left."

"The orange glow is power leakage from a communication device the high priest carries. Ignore it. The 'yellow specks,' however, are radioactive material harming the patient. They must be neutralized. Imagine that they are suddenly 'elsewhere.' "

"Do you mean like the hypercube?"

"Exactly. Try it now."

Klei made the mental adjustment and shifted Jud into hyperspace and back. He heard gasps from the others gathered around him.

"Am I done now, Grampa?"

"I am not your grandfather, and no, there is still more to do. The radiation has produced toxins and precancerous cells in his body. He needs strength to overcome them. Point the rod straight down. Imagine power flowing into him."

Klei did so and felt the man's illness fade away.

"A blood transfusion would be useful now, but soup and rest should be sufficient. There is no other radiation present here. A Zoology Research Probe has reached the site in the river now. It has started decontamination of the wreckage. There is no further danger."

Klei opened his eyes and spoke out, "Give this man soup and plenty of rest; he will recover. The danger of disease is gone." Color had already returned to Jud's face, and his breathing was easier.

"I'm going to live!" the deacon shouted, and then covered his mouth in embarrassment.

The high priest cleared his throat. "Your Highness—"

"Enough," the prince interrupted. "We are convinced. We will continue this discussion in our audience chamber. You may attend us now." The prince looked thoughtful as he turned and walked away. Attendants who had been hiding farther down the hall appeared and fell into place behind him.

With one last glance toward his patient, Klei turned and followed the prince. Behind him, he could hear the high priest shouting for a clean robe.

Klei entered the audience chamber and waited below the throne for the prince to settle himself. The high priest entered a few moments later, limping and slightly out of breath. He stood a few yards to Klei's left, and seemed to be fuming.

"We have heard," began the prince, "of the destruction of the Zorn and are impressed. We have seen the healing power demonstrated and are grateful for our subject's sake. We now wonder what you plan to do with this newfound power."

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Klei mumbled, "What should I say, Grampa?"

"I am not your grandfather. I am a machine. You must learn to rely on yourself. You have the ability. Tell the prince you are going to reestablish the hyperspatial gate between this world and the Galactic Federation."

Aloud he said, "I am going to reestablish the hyperspatial gate between this world and the Galactic Federation."

He looked out upon a sea of puzzled faces.

He took a deep breath and tried: "I am going to open a new trading route to a distant country."

The prince asked, "How large is this distant country? Is there enough trade to make such a route profitable?"

Klei queried the Sceptre.

"There are over four hundred billion people in the Galactic Federation."

"There are four hundred bil—, er, there are many people there. But they are spread over a vast wilderness. Very vast."

"If they are such a large people," the prince asked with growing interest, "why have we never heard mention of them before?"

"Ah, actually, Your Highness, many of the ancient texts have been lost, so there is much we don't know."

"Enough. Why should you be our envoy to this distant land? Why should not our high priest be the one to wield the power of the Sceptre? Or, for that matter, why not ourselves?" The prince was leaning forward on his throne; his hand was extended, palm up. The high priest made a gurgling noise, as if trying to restrain himself from speaking out.

Klei mumbled, "What should I do?"

"You could place me in his hand."

"What!?"

"We are mentally linked now. Physical contact is no longer necessary. He will not be able to do anything with you in control."

Klei hesitated for a second and then walked up the dozen steps of the high dais. He placed the Sceptre in the prince's hand and then walked back down, half closing his eyes to concentrate on the Relic and reassured by the feeling of contact with it.

The prince smiled as he raised the Relic up above his head, and then looked puzzled. "Gildwin, why do we feel nothing of the legendary power?"

Klei glanced sideways and saw the high priest's right hand slipping inside his robes, as if seeking sanctuary there. "Perhaps, Highness," the high priest said, trying to hold back his anger, "a prayer of purification to begin with — *aieeeee*!"

A loud snap came from within the high priest's robe, and the room was suddenly filled with an orange tempest. Klei fell to his knees as everything seemed to spin around him. From nearby he heard moaning and smelled burning flesh. And from above, where he had last seen the prince, he heard a distant voice screaming, "Take it back! I don't want it!"

Klei struggled to his feet and called out, "What happened? What should I do?"

Silence. He tried to concentrate on the Sceptre but could not sense anything.

Peering through the orange tempest he saw a whirlpool of geometric lines above the dais. In the center, appearing

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much too far away, was the prince, his cries getting fainter. A strong wind had started flowing from all sides of the room toward the whirlpool. Banners all around the audience chamber fluttered and twisted. Guards and attendants alike were running toward the exits, many shielding their eyes.

Klei cried out again, "Tell me what to do!"

Still nothing.

He bowed his head, the fierce wind tugging at his hair and clothing. "What should I do?" he sobbed.

"Heretic!" the high priest screamed at him. "It's all your fault!"

Klei spun around from the sudden accusation and stumbled, falling backward against the steps of the dais. He saw the high priest with his hand wrapped in part of his robe. Burn marks were obvious along the sleeve and exposed skin of his arm.

"What happened to your hand?" Klei asked without thinking.

"Have you no manners, peasant?" As he approached Klei, the wind picked up and the orange tempest intensified. Gildwin hesitated, struggling with the wind, and then continued forward. He leaned over to grab Klei with his good hand.

The gale grew even stronger. The high priest was thrown off his feet and began to slide towards the whirlpool above. Klei gripped the high priest's arm while desperately holding on to the steps. What had the Sceptre said? Something about a power leakage from a device the High Priest carried. And it seemed that the closer the High Priest moved toward the whirlpool, the stronger the wind became. Klei had an image of the wind becoming so strong that it pulled the stones from the castle walls, and then the clouds from the sky.

Careful not to lose his footing, he crawled down the stairs, dragging the high priest after him. The wind decreased to its former level, confirming his idea. He had to get the cause of this storm away from here.

They backed away from the dais to a point where they could stand. Gildwin looked visibly shaken by what had just happened. "Quick!" Klei shouted above the noise. "Give me the device you carry; I have to get rid of it."

"Blasphemy! Only a priest may handle a Relic—"

Klei grabbed his robes, feeling an egg-shaped lump underneath. "I'm sorry. I really am, but we don't have time to talk about this." He ripped the high priest's robe. The amulet, freed from its hidden pocket fell to the floor and began rolling in the wind toward the dais, sparks now spraying from it.

Klei ran forward and leapt, landing on it with his chest. He felt like he was being kicked in the ribs by an omphant, over and over again, as raw energy poured out of the damaged Relic. For the second time today he ripped off a shirt. Wrapping it around the device to shield his hands from the energy, he gathered it up. Stumbling to an open window he leaned out and saw the empty courtyard three stories below, illuminated by the afternoon sun. His fingers, blistered by proximity to the uncontrolled power, had become numb.

As he was about to release the bundle, he caught sight of someone on a balcony across the courtyard. In the glare from the sun, the man looked very much like

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his deceased father. A lump rose in Klei's throat as he remembered his father's devotion to the Ancestors, and the reverence his parents had instilled in him for all Relics. He remembered his parents' joy when he had stood before them, dressed in his gown for the Ceremony of Attainment. It marked the first time he was permitted to see a Relic. His mother had cried, saying he was now a man.

And it was all for the worship of *machines*. He threw the malfunctioning device straight down.

It flared briefly as it struck the ground, and then was quiet. Turning back into the chamber, he saw that the orange tempest had vanished, leaving only the whirlpool above the dais.

Klei reached out with his mind and made contact with the Sceptre. Breathing a sigh of relief, he quickly ran through the transport algorithm and brought the rod back to him, then gated Prince Tiamol to the floor nearby. The prince's skin was blue and blistered, but he was still breathing, so Klei turned to the whirlpool.

"It is a standard wormhole distorted by a non-terminating event horizon. All you have to do is—"

"I know what to do," Klei replied as he reached out and collapsed the vortex upon itself, leaving the room suddenly still.

"Your hands and chest should be treated. You could gate in the tissue reconstructor from the storage chamber."

"No, I have to do something else first."

People had started to return to the audience chamber, tending to the prince and picking up furniture, and all the while carefully watching Klei.

Ignoring them, he walked to a bare stone wall in the side of the chamber. He took a deep, painful breath and raised the Sceptre before him in his scarred hands. It glowed with a painful violet light, brighter than he had seen it before. The wall wavered and the sound of tearing rock pierced the air. As suddenly as it had started, the sound stopped and before him was a set of double doors, the polished steel surface reflecting his image. Klei spread his arms wide and doors swung open. People gasped.

Beyond the doors were stars. ■

●Every sublime conquest contains its own perils; one man encounters what he fears, another what he dare not hope for.

Pietro Metastasio

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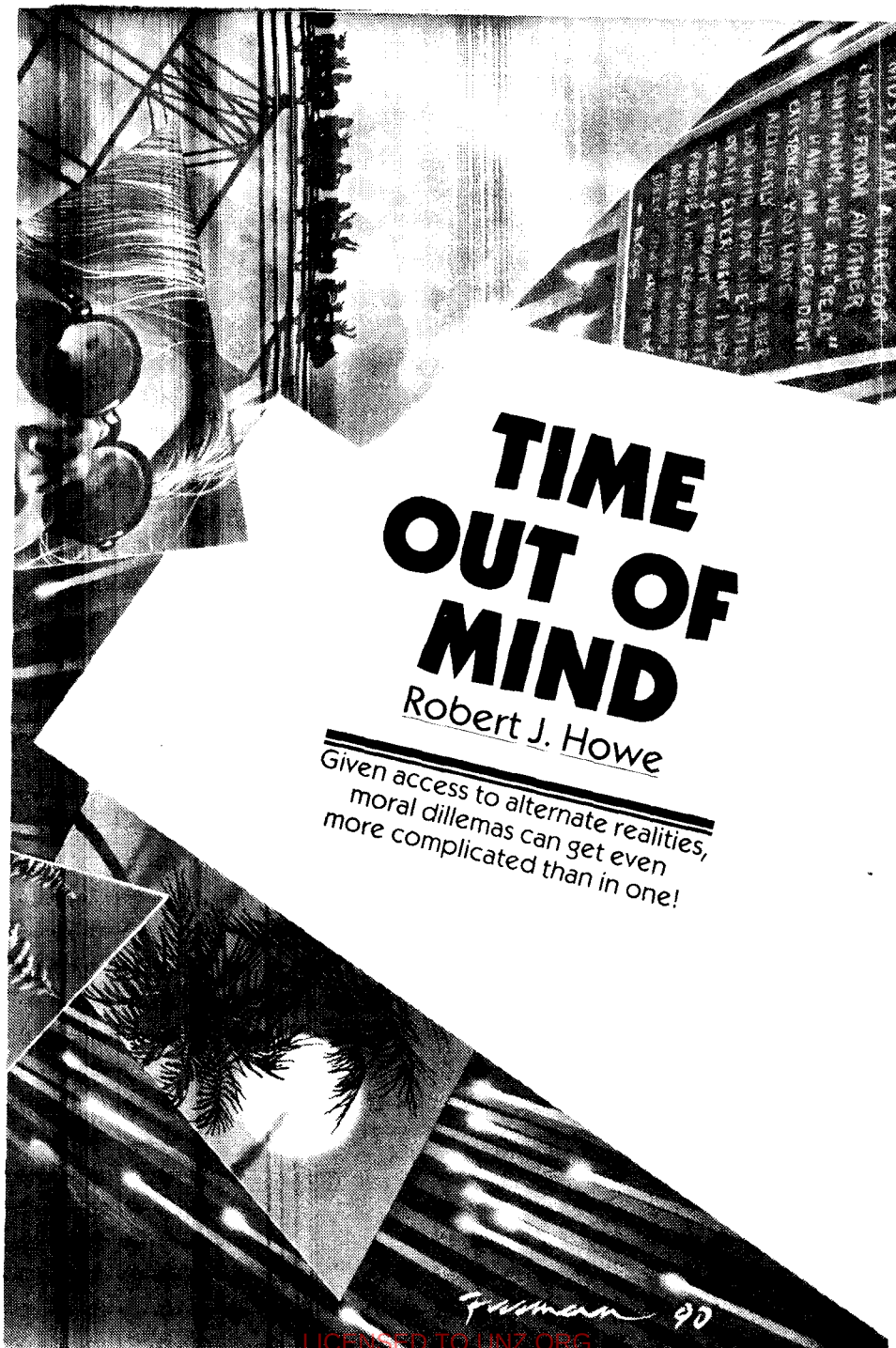

TIME OUT OF MIND

Robert J. Howe

Given access to alternate realities, moral dillemas can get even more complicated than in one!

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Karel Moss settled comfortably in his office chair and closed his eyes. He visualized the continuum that he thought of as "red house," and flattened the sinewave in his mind's eye.

Nothing happened.

He opened his eyes and looked around the room. No, this was MIT *prime;* he hadn't made the jump without knowing it.

He settled deeper into his chair and did the relaxation exercises until he felt limp and drowsy. He visualized red house again and pressed the sinewave flat. As it became a straight line he leaned into the stream, felt no resistance, overbalanced and jerked upright in his chair.

His heart was beating fast and his chest felt tight. There was nothing there. The red house continuum was missing. While he waited for his heart to slow down—an eighty-year-old man only had so many beats to use up—he wondered what had happened.

He took a carotid pulse a few minutes later. Over seventy; still too high. And his hands were trembling a little yet from the scare of the mental misstep. He did another relaxation exercise, then just sat quietly, trying not to think of anything in particular. It was almost half an hour before his body was relaxed enough to try again.

This time he chose the continuum he called "sepia nudes" in his head, for the picture that hung over the office desk there at the Institute for Advanced Biofeedback Physics. That continuum was a very close match, within two points on the Truberg scale, and except for the nudes, the different system of telephone area codes there, and a few other details, it was indistinguishable from his home continuum.

He flattened the sinewave and leaned into the stream, then jerked back at the last second, afraid of pitching forward into nothingness. That last attempt at the "red house" continuum had made him a little gun shy.

On the second try he slipped into sepia nudes without a ripple. He was sitting outside in that continuum, feeding the brazen squirrels that stalked the Massachusetts Institute of Technology's lawns. The sun felt good on his bare arms. He loosened control and "remembered" what he was thinking just before his director entity arrived.

As soon as he finished feeding the squirrels, he was going to get an ice-cream cone.

His director entity was amused. This Karel Moss knew how to enjoy life much better than he did, even if he was recklessly clogging his arteries. He stayed with him all the way to the Haagen Daaz shop on Mass Ave.

Moss' first trip was memorable, if not very dramatic. The Mark I Quantum Barrier Separator was a crude laboratory prototype; an oscilloscope and skull electrodes breadboarded into a Cray 26B11. The QBS was not a time machine in the sense most people would use the expression. Events happened in realtime, and the past was gone just as irrevocably in alternate continua as it in the home continuum. What the QBS did was train the mind to transit from one continuum, or reality, to another. The other continua were noncollapsing

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quantum states, superpositioned all in the same physical space.

Moss did the relaxation exercises, then proceeded to try and flatten the sinewave. Twice it sprang back when his concentration slipped, then, when he did make the transition, the wave snapped back so quickly he thought he'd failed again. It was only when he looked down and saw the white shirt and red tie he'd visualized that he realized he'd made it through.

He got up and walked around the lab, touching familiar pieces of equipment and nodding to himself. When he flattened the sinewave again he found it much easier to do. As the equations predicted, there was a bias to the stream; what Moss called the Director Entity almost unconsciously returned to its primary continuum.

"Something very strange happened," he told Jeffrey Truberg as he fixed them tea. He *wanted* a glass of milk and chocolate cake, but he felt guilty having already eaten ice cream that day. It was irrational, of course; the physical being who'd consumed two scoops of vanilla fudge was in another continuum, but he felt guilty nonetheless. "I tried to get into a continuum I'd been to before and I couldn't do it."

Moss' post-doctoral researcher and partner in biofeedback research looked up from the pad he was doodling on. "Hardware problem?" he asked.

"No, no. I wasn't connected."

"Maybe you were too stressed to enter the stream?"

"No, that's the the odd thing. Lemon?"

"We have no lemons, Karel. What's the odd thing?"

"I *did* enter the stream. I felt like I was pitching forward. It was . . . unsettling."

"You entered the stream but not the continuum?"

"Exactly. As if there was an empty space there." Moss settled himself at the kitchen table, ineffectually waving away a moth that bumped noisily around the lit globe of the lamp. "Can we get that screen fixed?"

"I'll do it Saturday. What happened then?"

"You don't have to do it yourself, Jeff. Call a man in to have it done."

"I'll call in a *man,* then. What happened?"

"I felt as if I were falling forward. I snapped back to the home continuum then."

"Did you try again?"

"Several times. That falling sensation happened on the last one. Then I tried another continuum. I went into that one without any effort at all."

Moss stirred his tea absently. "Why do you suppose that was, Jeffrey?"

"Could be almost anything. Stress, fatigue."

"But I entered the stream. . . ."

Jeffrey nodded. "True. Anything about that particular continuum that you really had to reach?"

"No. Why?"

"I don't know, maybe you were trying too hard and tensing up at the last second."

"You know, Jeffrey, it could have been, but it just didn't *feel* that way. Everything felt normal, then I just pitched out into space."

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They sat up until after midnight, drinking tea and discussing what could have gone wrong. They called an end to the brainstorming session when Truberg had run out of sheets on his legal pad.

"As I see it we either have a psychological/physiological problem, or we have to rethink the whole theory of operations, or both," Jeffrey said, grimly. "I'm glad we were able to narrow down the options."

"It's not as bad as all that," Moss said, putting his teacup in the sink. "It could be something simple that we haven't thought of yet." He turned the faucet to rinse the cups, then stopped and looked over his shoulder at his protégé.

"Jeffrey, we have to cancel everyone's access time to the machine and put an advisory out for the ones who are checked out on free transit. We still don't know what happened, and we wouldn't want anyone getting hurt."

Truberg made another note among the doodles on his pad. "Christ, Miller is supposed to be on tomorrow morning. She's going to raise hell when we tell her she can't have the machine."

"I'd rather have her raise hell than have somebody get hurt," Moss said. "I mean it, Jeffrey, no exceptions."

"It's biofeedback, essentially," Moss said to Dinardo, the North American Science Foundation auditor. "The supercomputer and all that is only necessary the first few times, to train the brain into recognizing the correct patterns and forming the requisite fields. I could make the transition now, while I'm sitting here talking to you."

"Would I notice?"

"No. Well, perhaps when I came back it might seem that it takes me a few moments to pick up the conversation, but otherwise you wouldn't notice anything out of the ordinary."

"Why not?" Dinardo asked.

"It's still me, after all. Just as those other continua are me as well. The only reason there might be a lag in the conversation is that it would take me a few tenths of a second to *remember* what we are talking about—to let my director entity catch up with what's been happening in this continuum."

"Can you go to a continuum where you are not part of the change? Say one where there is no L-5 telescope, or where the North American Common Market doesn't exist?"

"Of course. I've already been to several of them. There are trillions and trillions of continua—numberless except in the sense that there is a formula that theoretically should account for them all; V to the V power, where V is the number of variables involved. The more we open the QBS to general research the more likely political and social scientists will probably be murdering each other to get time on it. Imagine being able to study a neoagrarian society in realtime, or a complete global government, rather than having to rely on computer models?"

Moss sat in his office, trying to construct an experiment that would tell him whether or not his failure to get into the red house continuum was an internal or an external problem. Because of the way he'd experienced his inability to enter

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that continuum—the falling sensation—he suspected it was an external block.

He made a list of the continua he'd visited at least twice, and was slightly surprised at the length of it. After some thought, he divided the list into several categories; continua where he was a physics biofeedback researcher; continua where he was just a physicist; and continua where he had another profession altogether.

He felt a little uncomfortable with the arbitrary divisions, but he was anxious to get down to testing out his theory. He chose five continua from each category. If there were any more that he couldn't enter, he hoped he'd be able to see a common thread linking them and the "red house" continuum.

Moss closed his eyes and sank deeper into the chair, his mind floating on the edge of sleep. He didn't know he'd made a transition until he felt hot water on his back.

The soap in his eyes and the rush of water disoriented him for several seconds. Eventually he realized he'd transited to what he thought of as the "Carla continuum."

He rinsed off while his director entity "remembered" the timeline. His daughter in this continuum, Carla, was working in her studio and wouldn't want to be disturbed for any reason short of a natural disaster. He was a little disappointed that he couldn't see her now. He thought her very much like Jeffrey Truberg, a sensitive, sensible person, and always felt a mild pang of regret that her mother had died before Moss had been able to travel between continua. On the other hand, if she wasn't sequestered away in her studio, he would have wasted experimental time "visiting" with her.

Amused by his contradictory emotions, he relaxed and let the bias carry him back home.

Moss' director entity found himself dozing in the chair, a magazine in his lap. The transition fully woke him, an uncomfortable sensation, and he tossed the magazine aside. Fourteen more continua to go. He visualized himself in another familiar timeline; one where he'd joined the Union Officer's Training Corps at university, and had taken a commission in the Space Arm upon graduation rather than going on to a doctoral program.

He found himself in another shower, this one smaller around than a Rapi-Drop elevator, the force and heat of the water taking his breath away momentarily.

Part of his mind wondered at the weird synchronicity of events while the rest caught up with the new timeline. There seemed to be no noticeable difference in how long it took him to "remember" his history in a continuum with relatively major changes, as opposed to those where just one small detail was different. A good thing, he thought, or it might take hours to adjust each time he made a transition.

He was operations officer inboard the NASC *Cleveland*, an extra-system research vessel, and he was currently washing off the accumulated funk of nine hours in a pressure suit, having just supervised an antenna replacement detail on the downside hull.

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The SA required its officers and crew to be in top physical condition, and Moss found himself thirty pounds lighter and considerably more muscular than in his primary continuum. The combination of that, and working in seven-tenths gee, (less triggered Low Stress Syndrome, a low-gravity degenerative disease), made him feel young and full of energy.

Someone rapped at the privacy door of his cabin and Moss stuck his head out of the transparent plastic shower tube.

"Yes, what is it?"

"Watch in fifteen minutes, Mister Moss."

'Very well . . . Dazai," Moss's director entity had to loosen control to remember the crewman's name. "Thank you."

Moss dressed in his work uniform, an ordinary blue flight suit with silver collar insignia, and went forward to the pilothouse to assume the watch. His director entity thought that he should go back and try another continuum; it only took a few seconds to verify that this was indeed the timeline he'd aimed at, but he enjoyed this version of himself in a Walter Mittyesque way.

After being briefed by the officer he was relieving, Moss let himself detach somewhat and watch his alter-ego run the watch. For a short while everything was new and fascinating, but once he'd remembered everything there was to know about an underway watch, and there was a great deal of it, the work itself was routine and rather tedious.

Between instrument checks, the navigation technician, Glastone, talked incessantly about his plans to leave the fleet next homeport, and attend the academy.

"Glas, please," Moss finally said, "I can't hear myself think."

A sullen silence replaced the navigator's companionable chatter, and Moss was immediately sorry for snapping at the man.

As he probed deeper into his host self's psyche, Moss found out he wasn't terribly well-liked by the crew to begin with. He had a tendency to be short with them, then extravagantly apologetic.

The self-examination got to Moss very quickly. As much as he tried to tell himself that his alter-ego was not *him*, Moss couldn't shake the feeling that his waspishness and preoccupation with detail had been magnified by the insular world of deep space ships to make him the inconsistent, unpleasant officer he appeared to be. While he was giving orders to run a simulator drill on the nav-computer, Moss relaxed into the stream.

He was surprised to find that only twenty-five minutes had gone by. Moss checked the next continuum on his list and leaned into the stream.

He was getting better at letting his director entity relinquish control while he adjusted to his new surroundings, so it was that Moss didn't entirely lose his balance and fall two thousand meters to the base of the glacier.

"Doctor Moss, are you all right?" an aide asked, holding him firmly by the elbow.

"Fine, ah, Edgar. I just slipped a bit."

His aide, who bore a striking resem-

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blance in demeanor to Jeffrey, reluctantly loosened his grip. "They say it happens to most people on their first trip to the barrier, you get lost in the view and miss your footing. All I can see is snow."

Moss nodded, only half listening while he caught up with the goings-on in this continuum. After a brief pause he and Edgar followed the rest of the tourists along the narrow road cut into the top of the ice mountain.

The glacier was one of several that ringed the human settlement on Titus IV, part of what the locals called the High Fences. The view south from where they stood was a flat, snowy plain, much vaster and flatter than anything on Earth because of Titus; greater size. The only landmarks on the oversized landscape were a tiny cluster of spires to the southwest; the tips of religious shrines built by the indigenous non-human population.

Moss savored the biting cold air and the squeak of hard-packed snow underfoot, totally unlike the stale, overconditioned air inboard the matter conversion ship *Monongahela Pioneer*.

Or, for that matter, the musty smell of his office. Reluctantly, he leaned into the stream and slipped back to his home continuum.

He checked off that continuum on his list, and looked at the next one he'd written. It was one where he was a physicist at Berkeley. He took a deep breath, exhaled, and entered into the stream.

He was standing in the front pew of a church, listening to organ music. In a few seconds he "remembered" that it was a funeral for Norman Hager, from Berkeley physics. Norman was *his* age. As soon as he articulated that thought, he transited back to his home timeline.

"So you can get a wide range of experience with the QBS," Dinardo, the government auditor, said.

"Well, yes and no. It seems that external variables, external to the traveler, that is, are disproportionately represented."

"How so?"

"I'm not sure. You might want to get a psychologist's perspective on this, perhaps one of the personality people at UCLA," Moss hedged. He felt inexpert in this particular area of the research, and he didn't want to commit himself.

"I'm just getting background, Doctor Moss. You don't have to speak for the record."

"Well, from my experience and my research associate's, it appears that one's personality is much more rigidly set than we'd supposed. Even given a wide range of life circumstances, one tends to be the same person in all the continua. It rather limits the type of careers and relationships we find ourselves in."

"You think the reason you couldn't get into the "red house" continuum is because you'd died there?" Jeffrey asked.

"Yes," Moss said. "Isn't it obvious? I experienced a void there because the timeline was cut short for me. Well, not cut short, perhaps. I'm eighty-one in that continuum as well."

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"Eighty-one isn't so old, Karel. More people live into their hundreds than not."

"Hah. Wait until you're eighty-one. I have a bad heart. I *feel* old, Jeffrey. Part of it is realizing that one of my alter-egos has already died, I suppose, but there's no denying that I'm slowing down. It takes me ten minutes to climb the stairs in the morning, and I think I'm a little deafer every day."

In truth, the realization that the Moss in the red house continuum was dead had deeply shaken him. It was hard enough to see contemporaries pass on, but to contemplate one's *own* death after the fact really brought on feelings of mortality. Creaky joints and obstinate bowels were not just nuisances, but signposts.

Moss needed to say more about it, but he saw that Jeffrey was uncomfortable with the direction the conversation had taken.

"In any case, I'm reasonably sure that's what happened. The first thing we should do, I suppose, is make up another advisory for the people who we've already trained," Moss said.

"What do you think would happen if you tried to transit into a dead continuum?"

"Nothing, I fervently hope. Unless you tried to push it past the point of that falling sensation. If you were to push it past that point . . . I just don't know. I assume you would merely snap back to the home continuum."

"I just thought of a way to check this," Jeffrey said.

"Yes?"

"I'd prefer you let me try it."

Moss shook his head. "Don't try to sell me a pig in a poke, Jeffrey. Either it's safe to try or it's not, and either way we'd have to discuss it first."

"It's not that I don't think it's safe, exactly," he said. "Well, if I visualized a continuum where I was terminally ill, then kept trying to return to it at regular intervals . . ."

Moss thought about it for a moment. "It's a good idea, but I'll do the experiment."

"Why you?" he said. "There's no reason why I can't do this just as easily."

"Yes there is, Jeffrey," he said. "I already know that falling sensation; I'll have something to compare the experience to, and you only have my description of it to go by."

Jeffrey argued his case for another twenty minutes, but Moss' will prevailed. It was not an experiment he was looking forward to, and Moss almost changed his mind and let Jeffrey perform it, but his conscience wouldn't let him shirk a job merely because it was unpleasant.

They would design the experiment together the next morning, then Moss would make the jumps to find a suitable continuum.

"Are there any problems with the QBS?" Dinardo seemed to ask this almost as an afterthought.

Moss looked uneasy. "Some things, yes. There is potential for people to abuse it."

"How? I thought that events in one continuum had no impact on those in another."

"That's true, but one might use the device as a realtime laboratory. Do you

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want to know if you can commit a crime and get away with it? Or on a national scale, how your new weapons system will fare in a combat environment? Uncertainty breeds an awful lot of benign inaction, I think.

"Of course, there are literally millions of other uses that are extremely beneficial. Researchers who want to know the result of a particular experiment can just travel to a continuum where it's been done and look at the results; the purest kind of thought experiment."

"Will researchers be able to see the *consequences* of their technology, as well as the how-to?"

"Only to a certain extent," Moss said. "You have to remember that there are physical limits on how much more advanced another continuum could be. The amount of time it took the Earth to form since the Big Bang, the evolution of human intelligence; even supposing one could find a continuum where things progressed 30 percent faster, a possibility I'm really not willing to concede, it isn't possible to see the results of our actions over very long periods of time, and certainly not by geologic time scales.

"The chance we take is that we'll be able to transit to a continuum that's more advanced along a particular path than this one is, and that path seems good. But as I said earlier, this isn't a time machine; the end of every path is far too distant to see. We really don't see into the future this way so much as we construct what we hope are viable models. Since there's been virtually no experimentation along that line yet, there's no saying how accurate those models will be. And all *that* is predicated on the assumption that the individual experimenter's world view isn't sufficiently different from the consensus view to skew the results completely."

"Isn't it possible for more than one person to transit together so they can check each other?"

Moss shook his head. "That was the first thing we tried once we proved it was possible to travel at all. Even with two people paired to the same QBS, and visualizing the 'same' world, there were still such dissimilarities between experimenters that they wound up in different continua."

"This may sound flip, but how do you know it's not a hallucination then?"

Moss smiled. "You ask the right question. At first we weren't entirely sure. We thought we might be inducing some kind of trance state. What we eventually did was send an experimenter into a continuum where he was a specialist in a field other than the one he is here, and gave him a list of questions to answer from that specialty. The result was that after he transited he possessed knowledge he could not have possibly gotten any other way."

"Does that mean you learn everything from every other continuum you visit?"

"No. You retain some things, I suppose, but unless you have specific questions in mind, you won't retain much more than what was on your host's mind at the time. I suppose it could accelerate learning somewhat, but it's too spotty to use as the sole method of tackling a specialty."

Moss was back in the Carla contin-

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uum, just to check up on research in alternate continua. And of course to see his "adopted" daughter. He had a pleasant visit with her, and then she had gone back to her studio. He fretted, while he caught up on his alter-ego's work, about the problem of crediting such work when it came time to publish.

True, the other Mosses were still "him," but that made him no more comfortable with the prospect of putting his name on what was really someone else's research without giving them proper credit.

He was about to return to his home continuum when a strange sensation overtook him. It took several minutes to realize that *another* director entity was in this continuum.

Though this possibility had occurred to him once or twice before, he'd never discussed it with Jeffrey. It was mentally unbalancing—almost as if he were riding on someone's shoulders who was riding on horseback. He wondered if the other director entity could tell that *he* was a stranger in this continuum. And it raised new questions about whether the host entities were aware of transiting director entities.

The host entity had been puttering around his den while Moss observed, but with the arrival of the other director entity, he'd left abruptly, and was heading toward campus. Though Moss was tired, he was interested to see what the other director entity was up to. At the same time, it gave him qualms about his own unthinking intrusion into host entities' lives.

The host entity entered James Carter Hall, a thirty-one story dormitory and student union building. Moss observed, a bit confused, as they took the elevator to the penthouse and walked out to the balcony.

It was early evening, and the host entity was shivering in his shirtsleeves from the breeze. Moss' confusion cleared when he saw the view. Streetlights were just coming on in Cambridge, giving it a toy landscape look. To his left, the Charles river wound through the heart of Boston; a glassy taupe ribbon reflecting the last glow of the sun off steel and glass.

Despite the chill, the host entity was enjoying the view. Moss was amused by the thought that the other director entity, like himself, must come from a continuum where there was no Carter Hall. He was thinking that he should take more advantage of the beauty available to him in other continua, when the host entity pitched himself over the balcony rail without any warning.

Time stopped. Moss clearly felt the other director entity leave the host. As soon as that happened, panic ripped through the host entity like a saw.

Moss felt the wind increase as the host entity twisted helplessly into a sickening, head-down position.

He tried to relax into the stream and let the bias carry him back to the home continuum, but the host entity's panic was contagious.

Every detail assumed crystal clarity; the feel of the wind against his teeth, the exact shade of gray of the concrete walkway, and the way his shirt snapped against his chest.

As the concrete slammed up to meet him, he thought of Carla.

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"How difficult is it to make the transition without the QBS?" Dinardo asked.

"Oh, very easy."

"If that's true, why hasn't anyone discovered transiting naturally, without the machine?"

"Who said they haven't?" Moss shot back. "No, first let me ask you something—can you wiggle your ears?"

"I don't know," Dinardo said, looking amused.

"Try it."

Dinardo sat still for a few seconds and concentrated on moving his ears. "Is that it?" he said, finally.

"No. You can't do it then, am I right?"

"I guess so."

"Good. Now try again. I'll hold the buzzer down on this intercom, and I'll let it up whenever your ears move. Got that?"

Dinardo shook his head. "Why not?"

Moss held the button down, producing a surprisingly loud buzz. Dinardo concentrated on moving his ears for almost a full minute before the buzzer stopped, and immediately started again as he lost his concentration. After several more minutes he found he could stop the buzzer for a few seconds at a time.

"OK, experiment's over," Moss said. "What do you think?"

"Your point is well taken; something I couldn't do ten minutes ago I can do now. A little. But isn't that just muscle training?"

"Sure, but it is the same principle as the QBS. A few minutes ago you couldn't imagine how to wiggle your ears, and now you can. Using, I might add, a very crude feedback device. Ideally I'd be able to vary the volume of the buzzer so you would sense when you were getting close. The QBS is incredibly more sophisticated than that. It takes a Cray 2B or better to interpret your brainwaves and translate them into a display you can manipulate."

Moss took a long pull at his diet soda. "Now, as to the first point; who says we haven't discovered transiting naturally? There have been creative geniuses and madmen since the beginning of time who claimed to have had out of body experiences. Who's to say they didn't? You could almost do it accidentally, or at least unconsciously."

The inspector nodded. "I may call you to clear up a few details," he said, getting to his feet, "but I think I have pretty much what I need. Congratulations, again. You're doing good work here."

Moss showed the government inspector out and went back to his office. Before he settled into his chair, he turned off the lights to forestall any further interruptions.

He must have screamed, because Jeffrey slammed into the office a moment later, eyes wide and out of breath.

"Karel! What's wrong?"

Moss had the sensation of being slammed back into his body. His pulse was racing and he was trembling with adrenalin reaction. He felt nauseous and couldn't seem to catch his breath.

Jeffrey frantically dialed the paramedics. Still out of breath from the frantic dash down the corridor, he gasped out the address between pants.

Moss closed his eyes and tried to compose himself. Bad enough if he had

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a heart attack and died right now, but he had to tell Jeffrey about the other director entity.

Two paramedics, a man with a sandy beard and a women who looked too young to be a high school graduate, attached a blood pressure cuff, electrocardiogram leads, and started an intravenous line of dextrose.

The man watched the EKG's tracings for several minutes.

"Well, I don't think it's an MI," he said.

Moss looked gratefully over the clear plastic nosepiece of his oxygen mask.

"It's *not* a heart attack?" Jeffrey said anxiously.

"I don't think so," the paramedic said. "More like an anxiety attack. Are you his son?"

Jeffrey blushed a little. "No, I work for him."

"We're going to take him to the hospital anyway, just to be sure, but I don't think it's anything serious."

"Are you a doctor?"

"No, but I bet I'm right. Are you going to go to the hospital with him?"

"Yes."

Moss was feeling better at that point, and greatly irritated that they were talking about him in the third person right in front of him. He didn't want to go to the hospital and be treated to more of that, and he had to tell Jeffrey about the suicide or murder or whatever it was.

"I'm not going to the hospital," he said, his words muffled slightly by the oxygen mask.

Both the paramedics and Jeffrey turned to look at him as if a stone had spoken.

He took off the oxygen mask and sat up. "I feel better. I was just . . . overwrought."

"I'll say," the bearded paramedic replied. "Your pulse was one-sixty when *we* got here. That's like sprinting a quarter-mile in a minute-thirty. Whether or not you've had a heart attack, you should still go to the emergency room and have a doctor look at you."

Moss knew the paramedic was right, but his pride was wounded and he felt he couldn't back down gracefully. Besides, he was anxious to get Jeffrey alone and tell him about the host entity's death.

"No," he said. "Vickers, my doctor, is just off campus. I'll see him tomorrow."

He saw Jeffrey open his mouth to say something and silenced him with a glare. He looked so hurt that Moss was immediately sorry.

"Well, all right," the paramedic said. "I can't make you go to the hospital. You're going to have to sign a release, though, saying that you refused treatment against medical advice."

It was another twenty minutes before the technicians were packed up and the papers were all signed. As they were walking out the door the younger technician, who hadn't said a dozen words all this time, stopped and took Moss by the arm.

"Tell me you'll go to a doctor," she said.

Moss was about to say something flip, but the look on her face suddenly reminded him of his alter-ego's daughter. He found himself promising to see a cardiologist as soon as possible.

"You should have gone to the hos-

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pital," was the first thing Jeffrey said after they left.

"Don't be angry with me," Moss said. "I'm sorry I was short with you, but I couldn't go."

Moss told him about the second director entity taking over the host in the Carla continuum, and about the suicide plunge from the top of the building.

They sat in silence for several minutes, Jeffrey because he apparently didn't know what to say, and Moss because he didn't want to share his grim thoughts with his protégé.

"Are you sure it was deliberate?" Jeffrey finally asked.

"Oh, there's no doubt in my mind," Moss said. "The host entity was doing something entirely unrelated when he decided to go to the top of that building, and as soon as the other director entity left, the host went into a panic. In fact, that the other director was able to transit so quickly tells us that he must have planned it. You can imagine how difficult it was to try and relax into the stream. . . ."

The image of the ground smashing up at him returned, silencing him in mid-sentence.

"And you think that this is what happened in the red house continuum?"

"I'm not *sure*. No." he finally said. "But I think it's likely. There is no way to be sure without getting into his head."

"Why would he want to?" Jeffrey said. "I mean, wouldn't it be too painful?"

"It seemed that way to me, heaven knows, but *he* transited before the end."

"Did you know what was going through his mind?"

Moss shook his head. "In retrospect I can say it was like feeling his emotions through a distorting mirror. At the time I felt uncomfortable, but I attributed that to the strangeness of having another director in the same host."

What Moss didn't say was that he experienced the other's emotions as the darker side of himself. He felt ashamed for what had happened to the other Moss, and somehow responsible. He was going to have to resolve this for himself before he could say anything to Jeffrey.

"Karel? Are you all right?"

Moss realized that Jeffrey had been saying something about the other continua.

"I'm sorry, I was drifting off," Moss wearily pushed up from his chair. "I'm rather spent from all of this, Jeffrey. Perhaps in the morning we can get a better grasp on it. . . ."

In truth, he was exhausted. He also wanted to think without interruption.

They drove home in silence, with Jeffrey tapping nervously on the steering wheel of the old Volvo. Even though it was only seven in the evening, Moss said goodnight as soon as they were inside. He eased himself between the cool sheets and turned off the lights.

Heavy drapes blocked out what little noise there was from their quiet street, as well as the dying afternoon rays of the Sun. He felt drowsy and ready to sleep, but he wanted to try one last thing before he turned in.

He did the relaxation exercises until he felt himself settle limply into the mattress. Then, gingerly, he pictured the Carla continuum and leaned into the stream. Despite his caution, he felt ov-

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erbalanced, as if he were falling for the second time that day.

A powerful wave of sadness swept over him. He would never see Carla again, and the bright, beautiful child would bury her father thinking that he'd committed suicide. She would probably always wonder and feel guilty, not knowing that there was nothing she could have done or said to keep her father alive.

He, on the other hand, could have done something, but didn't recognize what was happening fast enough. If he'd resisted going up to the penthouse!

He slept and dreamt of falling.

He woke before sunup, still tired, with the previous day's events already preying on his mind. The bedroom was chilly in the early morning, and he burrowed deeper under the covers despite a painfully full bladder.

There were things he *had* to do. Chief among them was finding the continuum of the director entity who'd committed the murder. Even from the distorted impressions he'd gotten through the murdered host, he was sure he'd recognize that Moss when he saw him. Then . . . then he just didn't know.

He was tempted to make the trip from the security of his bed, but in the end propriety won out. He knew it was irrational to think he had to be dressed before exploring other continua; he would be dressed or not, as was appropriate there, regardless of what he wore in his home continuum. Nonetheless, he dragged himself from bed, and after a brief, unsatisfying shower, dressed himself for work.

Jeffrey was at the kitchen table, eating Grape Nuts with horrible cracking noises of his jaw, and reading the *Globe*.

"Good morning, Jeffrey," Moss said, heading directly for the teapot.

"You're up early . . ." he answered around a mouthful of wheat gravel.

Moss wondered how he could put that mess down every morning.

"I slept badly, to tell you the truth," Moss said, pouring his English Breakfast tea. "I though I might as well get up and get something accomplished, as long as I wasn't sleeping."

"What's on the agenda for today?" Jeffrey asked when he was able to speak clearly.

Moss hesitated. He would like to tell Jeffrey everything, but he didn't think it was fair to burden the boy with his worries.

"Just thinking," he said. "I may make a few trips if I feel up to it."

What he planned to do was retire to his study and spend the entire day looking for the other's continuum.

"You said you were going to go to the doctor."

"Yes," Moss said wearily. "I'll be in my study, just give me a knock when it's time to leave."

He visualized another continuum where he was the director of the BioFeedback Physics lab, he assumed since the other had changed continua that he originated in one where there was successful QBS travel.

The office was familiar, but different from the home continuum. Moss looked at the matching wallpaper and carpet —this Moss was married, obviously.

It took a very little while to absorb

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the host's personality. A few seconds, if he concentrated on it, rather than on his surroundings. That was just as well; he had a lot of ground to cover.

The first thing he felt was anger. The host entity was furiously angry at someone. Moss blinked, taking in his surroundings. No wonder his host was angry; his car was smashed sideways against a concrete divider, pinned there by another car. Hundreds of square glass bits showered off his lap when he shifted in the seat. He looked in the mirror, not recognizing himself for a second because of a full mustache and beard. The sight of blood running from his nose made him queasy, and he stayed just long enough in the continuum to remember that the host hadn't killed Carla's father.

It was hot and dim. Suffocatingly hot. Moss wiped sweat from his eyes and tried to see. A sauna.

He sat back and relaxed into the host entity, letting the damp heat leach the fright from the car accident out of him. The steam smell evoked a pang of nostalgia; the memory of whistling radiators and cold winter mornings in his childhood home on Skillman Street. He reluctantly remembered what his host entity had been doing for the past few days. Nothing out of the ordinary. Moss transited back to his home continuum.

Along the way, Moss discovered he could skip from one continuum to another without returning to his primary. He also discovered that his director entity didn't need to sleep; he was as alert or tired as the Moss whose timeline he was visiting.

He tried to keep track of the number of continua he visited, but couldn't keep count in his head. Returning to the home continuum between each jump was the only way he could keep a written record of each attempt, but he soon abandoned it as too time consuming.

He was beginning to doubt the whole theory of the *Other*, as he thought of him. He was bored with the switching-channels sensation of flipping from one continuum to another, but even though he'd poked hundreds of continua already, he knew he hadn't even begun to sample the possibilities. He could search a million other continua without finding the incarnation of himself that killed Carla's father.

He felt frustrated and angry.

"Relax," the masseuse said. "You're tensing all your muscles again."

Moss started. He'd translated to another continuum completely unconsciously. He checked the host entity. Nothing. Irritated, he transited to the home continuum.

The cardiologist was just popping the wires off the sticky pads attached to his chest.

"Heart looks as good as can be expected," he said, sounding mildly surprised. "Are you taking an aspirin every morning?"

Jeffrey apparently saw the disoriented look on Moss' face.

"Yes, he does," he said.

"Where were you?" Jeffrey wanted to know when they were in the car.

"Looking for the Other."

"What?"

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"Looking for the director that killed Carla's father."

Jeffrey stared out the windshield so long that Moss finally asked what was wrong.

"Why didn't you talk to me about it?"

"I . . ." The truth was, he was ashamed of the Other. There was no other reason, beyond an amorphous need to protect Jeffrey. When he told him the latter reason, Jeffrey shook his head.

"Protect me? Karel, you're the one who *I'm* worried about. He can't do anything to me."

Moss nodded. He was right, of course.

"Jeffrey, I don't know what to say."

"Why are you cutting me out of this?"

"I'm not cutting you out of it. You can't enter *my* continuum, nor I yours."

"I *know* that. That's not what I mean. Why won't you talk about it?"

Moss felt pressured and uncomfortable. He rode the rest of the way home in silence.

He sat in his study after a barely civil lunch with Jeffrey, tapping a pencil on his blotter and thinking about the needle-in-the-haystack nature of his hunt for the Other.

Painful as it was, he mentally replayed his alter-ego's death, looking for some detail he could latch onto. The only significant detail he could recall, however, was the presence of the thirty-one story student center and dormitory in that continuum. He was worrying at that idea when the realization struck him.

All he had to do was visualize a continuum where he was the killer.

He avoided thinking about why that profoundly simple realization had eluded him this long and started the relaxation exercises.

He felt as if he had been jerked out of the stream. He couldn't separate the physical sensations from the effects of the transit, and it took a long four or five seconds to grasp what was happening.

He was on a roller coaster.

His host entity was on a roller coaster. Once he was over the initial disorientation, he relaxed and let the host take over. It was not at all what he expected.

Rather than a ravening psychopath, the host was entirely the opposite. He was in a roller coaster with dozens of people shrieking around him, reveling in the entirely normal excitement of an amusement park.

Perhaps he'd made a mistake. Moss "remembered" what his host had been doing the past few days, and was immediately sickened. There was no doubt that this was the entity who'd forced his alter-ego to leap to his death.

As Moss called up those memories, the host became excited in a detached, intellectual sort of way. He also wondered what had brought that to mind just then. Of course; falling. The only regret Moss found, in fact, was that he had not stayed in the falling body until death.

Rage burned through Moss as it had seldom done before. The host had snuffed out a kind, gentle man and left behind a distraught daughter and dear friends. He was also angry for himself;

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he would never see Carla, at least not *that* Carla, again.

He wanted the Other to suffer, and to know why he was suffering. He wasn't sure if he could make the Other understand the why, but he would try.

The roller coaster was cruising to a stop in front of the ticket platform. Moss' director entity asserted itself and paid for a second go-round.

While the set of six cars began its laborious climb to the top of the first drop, Moss raised his safety bar and slipped out from under it. Someone behind him called out, but he paid no attention, and whoever it was subsided when he sat in the seat again, this time atop the bar.

The cars pushed at the peak, then hurled down the steep pitch. Moss gripped the foam rubber padding atop the seat in front of him and poised himself. When the car made the turn and hurtled toward a roofed section of the ride, he stood up and scrambled atop the seat.

The screams behind him were no longer the delighted shrieks of people who had paid to have the daylights scared out of them; the urgency and fear in the calls made the riders in the front of the car turn to see what was happening.

Moss stood unsteadily in the sixty-mile-an-hour wind of the ride's passage, watching the steel edge of the roof bear down on him. He knew, intellectually at least, that he would survive the impact with the roof, even though the host would be decapitated.

The cries of his fellow riders became more shrill as the distance closed to the steel sheeting. Moss gripped the foam padding reflexively to avoid being jarred off a hundred feet above a forest of naked girders that supported the tracks.

Time telescoped. His eyes watered from the wind, and his adrenaline-logged muscles trembled as he raced toward the end. He simultaneously felt a vicious excitement and utter terror. The tiny part of him that remained detached realized that the excitement was his, and the fear his host's. It was enough to push him back over the edge.

His hair brushed the roof as he collapsed into his seat. He saw the rest of the ride looking straight up from the vantage point of the car's floor.

Jeffrey was sleeping. For a moment, Moss considered having a brandy before he woke him. No, he would lose his nerve. He stood for several minutes, poised at the side of the bed. Jeffrey finally solved the problem by rolling over and looking groggily at him.

"Karel? What time is it?"

Moss stood at the edge of the bed, trembling and mute. His eyes started to water, and his throat constricted with pain and embarrassment.

Jeffrey kicked the covers away and pulled a robe on over his shorts.

"Karel, what's wrong?"

"I just tried to kill someone," he finally said.

"You could have killed him, but you didn't," Jeffrey said. He was sitting across from his mentor in the study.

They both had snifters of brandy, and Moss was just beginning to feel a loosening of the sickening tension in his stomach.

"If he could kill, *I* could kill, Jeffrey.

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I didn't kill him because I was afraid," Moss looked up from his glass, "not because of any particular nobility on my part."

"What were you afraid of, getting caught? Being punished? It may not *feel* very noble, but those are the constraints that keep most of us from murdering someone over the course of our lives. What more do you want, sainthood?"

"I wasn't just afraid of getting caught, Jeffrey. I was in physical terror of hitting that roof, even though I knew I would survive it. . . ."

"Karel, you didn't kill him. When everything's said and done, that's what was important." He took a swallow of brandy. "Frankly, I wish you had."

"What?" Moss thought he must have misheard him.

"Actually, I really wish you'd talked to me about this before you started any of it, but barring that, I wish you *had* killed him when you had the chance."

Moss was amazed and horrified to hear this coming out of Jeffrey's mouth.

"What are you saying?"

"I wish you hadn't started any of this, Karel, but what do you think's going to happen if and when he realizes that another director tried to kill him?"

Moss stared at his protégé. "What are you saying?"

Jeffrey looked pained. "I'm afraid he's going to try to kill you."

Moss felt his stomach begin to knot again. He was right, of course. If the Other had killed his alter-ego merely for the thrill of it, what would he do to someone who was trying to kill him? He felt hopeless and powerless.

"There is a chance that he won't recognize another director entity was responsible for the roller coaster incident," Jeffrey said hopefully. "It does fit with his thrill-seeker mentality. . . ."

Moss felt a stab of irrational hope. "That's true, I suppose."

It was the expression on Jeffrey's face that told Moss they were both clutching at straws. Sooner or later the Other would try to kill him. The only way Moss could forestall it was by killing him first.

He drained his snifter and stood up. He was still afraid, but he was beginning to feel a resolve. He was responsible for this problem, not least because he'd invented the QBS, and he'd find a solution for it.

Jeffrey looked at him curiously. "Where are you going?"

"To bed. I'm exhausted, Jeffrey."

"But we haven't figured out what we're going to do, Karel."

"I don't know that there is anything *we* can do," he said. He saw the anxious look on Jeffrey's face. "I will tell you if anything occurs to me. I just don't think there's anything you can do to help right now."

"Suppose the Other, as you call him, tries to kill you?"

"What makes you suppose that there is only one *Other*?" Moss said as gently as he could.

Whether his director entity needed sleep or not, Moss wanted to be oblivious to his fear and responsibility for a while. He poured two more fingers of brandy into his snifter and drained it before he climbed the stairs to bed.

Jeffrey, I'm going to transit to the Other's continuum. I don't know what I'll do from there. K.

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Moss tucked the note in the corner of the bathroom mirror and went down to the study. He felt slightly guilty about not telling him in person, but he didn't want to wake him for the second time in twelve hours to give him worrisome news. Moreover, he couldn't bring himself to *say* that he was going to suicide the Other.

When he was in his favorite chair he visualized the Other's continuum and slipped into the stream.

The host was sitting at his desk at the Institute, playing with some version of a Rubik's cube. Though he was afraid that if he didn't suicide the Other immediately he would lose his nerve, Moss suppressed his own will and let the host continue with his play while he observed.

Mainly, he was puzzled. He wasn't sure why he'd stood up on the roller coaster the previous day, only that it had badly frightened him. He replayed the episode over and over.

The host then compared the sensation with that of the death of his alter-ego. Moss held his mental breath, waiting for the Other to make the connection and realize that another director entity had prompted him to stand on the roller coaster.

He didn't. Moss was amazed; he couldn't imagine how the Other couldn't see the thread that connected the two events. His confusion made him ease a little deeper into the Other's memory and try to recall what had prompted him to kill his alter-ego in the first place.

The insight caught him completely by surprise; the Other didn't believe that the other continua were "real," since they had no effect on his own timeline. He had tried to commit suicide in an alternate continuum, at considerable perceived risk, as an experiment in survival after death, and had panicked and transited back at the last second.

The Other was feeling his age, too, it seemed. And he'd had the same uncomfortable message from his cardiologist. Unlike Moss, the Other had refused the doctor's restrictions. The roller coaster rides were a show of defiance, more than anything else.

For the first time since Moss took the death plunge with his alter-ego, he felt a sense of relief. He still grieved for his alter-ego, and Carla, but he felt the weight of guilt removed from his shoulders. The Other was not a murderer, and to whatever extent the Other was Moss, *he* was not a murderer, either.

A thought occurred to him, puncturing his equanimity; what about the Moss in the red house continuum?

He tried to "remember" that, but his host had no knowledge of it. That was both reassuring and depressing. Reassuring because it meant that the Other wasn't a murderer, and depressing because if the other Moss had died of natural causes, the biological clock couldn't be too far behind in his continuum.

That still left him with the problem of what to do now. Suiciding the Other was not an option, if it *ever* was. But the Other might try the life-after-death experiment again, inadvertently killing another alter-ego. Perhaps even Moss himself. He could *think* about the other continua as real. The Other would remember the thoughts as his, but he would probably just brush them aside,

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since he believed the other continua were imaginary.

Moss slouched in the Other's office chair. Theoretically there was no connection between the continua except the director entities. He considered a dozen options in the space of a few minutes, none of which bore up under close examination. He stared blankly into space, frustrated and worried, when his gaze lit upon the chalkboard set into the wall.

He forced himself to sit still and look for the holes in the idea. There were none.

He got up and went to the board.

Moss, I am a director entity from another continuum. We are "real" and have an independent existence. You accidentally killed an alter ego with your life-after-death experiment. I was there. I thought you did it on purpose. I was responsible for the roller-coaster incident. I'm sorry; I didn't know the death was accidental until just a moment ago.

He paused and reread the note, then signed it. *Moss.*

Judging from the confusion on his protégé's face, he and Jeffrey were in the middle of a conversation when he returned to the home continuum.

"Karel?"

"Jeffrey, I'm back," Moss said.

"You were in the Other's continuum this whole time?"

"Yes. Jeffrey, it's not what we thought."

"What? What happened?"

Moss related what he'd discovered about the Other's understanding of the alternate continuum, and described his note to the Other while Jeffrey sat, wide-eyed. When he finished talking, Jeffrey shook his head.

"But what about the red house continuum?"

"Didn't know a thing about it. Coincidence. My alter-ego must have died from natural causes."

Moss let out a deep breath. "Of course, that doesn't bring back the Moss that *was* killed. I feel terrible about that."

"How do you think *he's* taking it?" Jeffrey said.

"I imagine he feels awful if he believed the note," Moss said. "But I didn't think I had any choice but to tell him." Moss looked at his watch.

"I want to check on him, Jeffrey, then we can talk some more."

Moss wasn't prepared for the almost physical pain of the Other's feelings. He was at his office window, consumed with fear and guilt. He'd obviously believed Moss' message.

Like Moss, he was overwhelmed by sorrow for his alter-ego's daughter. He was horrified by his mistake and shamed to the core, especially by the knowledge that another director entity knew about the deed.

As Moss looked on, he sat on the window sill and swung his legs out over the edge. It was then that Moss realized "his" office was near the top of a much taller building in this continnum. Just as the Other let go of the window frame, Moss asserted himself and threw his weight backwards. He landed with a thump on the mercifully thick carpet, heart pounding in his chest.

He had almost killed the Other with guilt and remorse. He lay on the carpet,

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breathing deeply and trying to calm his racing pulse. When he felt that he wouldn't seriously risk a heart attack by getting up, he pulled himself into a chair.

He sat for a long time, staring at his message on the blackboard and wondering how he could have been so insensitive to the Other's reaction. Out of fear for his own life, he had nearly allowed the Other to kill himself.

He tried to imagine what he could write that would dissuade the Other from trying to commit suicide once Moss had relinquished control. Everything that occurred to him seemed trivial compared to his feelings of responsibility and guilt. While he was grappling with his own sense of failure at having known much more of the big picture than the Other, an idea came to him.

The blackboard wouldn't do. He searched the desk until he found a pad and pen, then composed a letter to the Other. When he was finished he placed the pad in the center of the blotter where it couldn't be missed and leaned into the stream.

"What happened?" Jeffrey wanted to know.

"He was trying to kill himself," Moss said wearily.

"What did you do?"

Moss leaned back in the chair and rubbed his eyes with his fingertips. "I wrote him a letter."

"What did you say?"

Moss hesitated. He wanted to tell Jeffrey that he was too tired to discuss it. He wanted to do anything but talk about what he'd written, but Jeffrey deserved better than that. He might have to face that side of himself some day, and at eighty years old, Moss couldn't take the chance that he might not be around.

"I told him that I was sorry. I apologized for not thinking of how he would take the news that he'd actually killed someone." Moss shook his head. "But that wasn't the important thing. This is hard to say, Jeffrey. I told him how much I'd wanted him to suffer after he'd killed the other Moss. I told him how angry I was, and how I planned to kill him on the roller coaster. I told him that, at the time, my only regret would be that he didn't know *why*. And I told him that the only reason I didn't kill him was because of my own fear."

"Do you think that will stop him?" Jeffrey sounded dubious.

"I don't know. I don't much care for myself, right now. I let him see that. I just don't know." He suddenly felt wrung out.

He got unsteadily to his feet and headed for the stairs. "I'm going to go up to bed. Good night."

Jeffrey looked uncomfortable. "Aren't you going to check on him?"

"I can't, Jeff. I told him that. I'd rather not know."

Moss started slightly. He was sitting at his computer terminal at the Institute, and he felt as if he'd dozed off for a moment. When his eyes focussed on the screen he sat bolt upright.

"Jeffrey!" he called, his voice rough.

He heard his protégé's chair scrape away from the desk in the next office, then Jeffrey strode in through the open door.

"What's . . . is something wrong?"

"I don't know. Was I asleep?"

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Jeffrey looked confused. "Not a minute ago, you weren't."

"You didn't touch my keyboard, did you?"

"No. Why?"

Moss looked at the screen. He felt sad, but that wasn't why his eyes were beginning to water. He gestured for Jeffrey to read the two sentences printed in capital letters.

I CAN LIVE WITH IT IF YOU CAN. THANK YOU. ■

IN TIMES TO COME

● Next month we lead off with Part I of a new three-part serial by Harry Turtledove, with another cover by Nicholas Jainschigg, focusing on further adventures of a character some of you will remember from earlier stories. Jennifer Logan, the future Middle English scholar who aspired to settling into a nice academic job after sampling the life the old science fiction writers tried to describe as an interstellar trader, finally has her collegiate position. You might think that a dull life by comparison, but that depends very much on who your students are! Jennifer has some who are *very* dedicated, in their own way, and the hot water she soon finds herself in as a result is *very* far from academic. . . .

The April fact article is something a bit different: a transcript of a panel on "Starships, Robots, and Space Travel for the Next Millennium," held as part of an avowedly visionary symposium conducted last year at the NASA Lewis Research Center. The panel was moderated and put on paper by *Analog* regular (and NASA physicist) Geoffrey A. Landis, and the panelists included Robert L. Forward, Marvin Minsky, Theodore Taylor, Joel Sercel, and Paul MacCready—so you can count on some provocative thinking!

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CLARION '91

The 24th Clarion Workshop in Science Fiction and Fantasy Writing will be sponsored by Lyman Briggs School at Michigan State University from June 23 to August 3, 1991.

Clarion is the oldest and most successful writing workshop in the science fiction and fantasy field. Over a third of its graduates have since published, among them Ed Bryant, Lucius Shepard, Vonda McIntyre, Michael Talbot, George Alec Effinger, Kim Stanley Robinson, and James Patrick Kelly, to name a few.

Writers-in-Residence for Clarion '91 will be Tim Powers, Karen Fowler, Ellen Kushner, Tom Disch, Kate Wilhelm, and Damon Knight. Editors-in-residence, on two Saturdays, will be Gardner Dozois and Gordon Van Gelder.

Members of the Clarion Workshop enjoy borrowing privileges at the (over 3,000,000 volumes) MSU Library, which also includes previous Clarion manuscripts, as well as the Voice Library and the Russell B. Nye Popular Culture Collection.

"Clarion is the literary equivalent to boot camp," says Tom Disch.

For application forms (application deadline is MONDAY, APRIL 15, 1991), or more information, contact:

David E. Wright, Director, Clarion '91
℅ Mary Sheridan
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The trouble with really big dreams is that they take a long time to realize.

SUMMER HOPES— WINTER DREAMS

Mike Moscoe

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I gasped, struggling for breath. The light streaming through the lock dazzled my eyes. I saw everything as through a misty haze. The aliens surrounding me raced forward with howls and shrieks. Faltering, I stumbled back until my spine rested on the thin cool wall that separated me from the vacuum of space.

I swallowed, gulping down drafts of air. "Get a grip, man," I told myself. "After all, no one made you come."

The air brought me back from the edge. It smelled familiar, of machine oil, electronics and clean bodies, no different from the air on the naval vessels I had visited when I was a kid. Wet navy, I mean.

I blinked, and realized there was nothing wrong with the lighting. The mist that had dazzled me was on my own eyeballs, not from the subdued and recessed overhead lights. The brightwork did gleam, though, and everywhere I looked some sort of computerized readout flashed its tale, measuring reality.

Squaring my shoulders, I forced a resolute smile, and stepped forward three paces. A glance down told me I was on the threshold. I took the next step.

There I was, a week before my seventy-fifth birthday, standing on the quarterdeck of the starship *Enterprise*.

The teenagers who had ridden up on the shuttle with me kept up a running commentary on the wonder of it all in a language three-quarters alien to me. While they sorted themselves out and connected with their crew member parents, I stood stock still, soaking it in, unwilling to move. I guess I was afraid I'd wake up. This was the moment I'd been dreaming about since before I was out of diapers.

My earliest memories are of sitting in my mother's lap watching the strange goings-on of that strange ship on TV. As a little kid, I kept hoping for Scotty to beam me up, especially around exam time. I guess I knew all along that the *Enterprise* wasn't for real. It was the summer I turned thirteen that the full meaning of what that meant landed on me like a ton of bricks.

That was the summer I really started to read. And, of course, it was "Star Trek" I read. I bought every novel I could lay my hands on, and then begged Mom or Dad to take me used-bookstore hopping. We must have covered every one in Portland, Oregon. And any trips out of town had to allot time for a bookstore or two. Even our annual summer week at the beach started with a stop at a secondhand store. I turned up two more old ones, including "The Fate of the Phoenix." Oh, to be Captain Kirk's replica!

But about Wednesday of that week, as I huddled in my nest up in the cottage loft, the futility of it all swept over me like a tholian web. The *Enterprise* was in the twenty-third century. I was marooned in the twentieth. With tears stinging my eyes, I went looking for my dad.

I found him where I expected to, out on the sun porch with his nose in a book. This one was on the civilizations of ancient China. Beside him, half read, was an old Poul Anderson novel. Dad was

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reading two books at once, switch-hitting between future and past.

He looked up as I came in. After one glance at me, he closed his book on a finger. Looking around for a marker, he filched a sand dollar I had brought in that morning from our walk. He put his book down on the table beside him and smiled. "Friend, you look like a man with a problem. Do you want to talk about it?"

"What's the use, Dad? It's never gonna happen. I'll never see it." I could feel a hot tear trace its way down my cheek. Mad at the world in general, and now at myself for crying in front of my dad, I turned angrily to face the ocean.

"What's never going to happen, Son?"

"Me, going to space. You know what I mean." Which wasn't really fair, because his next words showed that he still didn't know what I meant.

"Well, over the next twenty, thirty years," Dad began in that reasonable voice of his I hated at a time like this, "there will be plenty of jobs in orbit, the Moon, too. You can be most anything you want to be. Pick a profession and shoot for space."

"Oh Dad, that's not what I mean." I whirled on him, tossing the Star Trek novel in his general direction. It was maddening that he could be so calm while I felt so miserable. "I mean real space, not that baby stuff NASA's doing. Even what little they do blows up in their faces. And they take *forever* to get things going again." Dejectedly I plopped down in a chair. "Nothing's going to happen in my lifetime."

I stared out at the ocean. The waves crashed against the sand and rocks. They had been doing it for billions of years. Two hundred years from now they would still be doing it. The ocean had forever. I didn't. On the northern horizon, black clouds gave promise of a storm.

My father frowned. He was a true believer where space was concerned. I had gored the sacred cow. I figured he would be ready to burn me at the stake for heresy.

But he surprised me. After a while, he came over and stood beside my chair, a hand resting on my shoulder, his own eyes gazing out at the far horizon. It was a minute or two before he said anything. And then his words were soft, gentle. "It must be terrible to be a child of your generation."

"Huh!" I mean how often does a parent give his kid credit for having it tough? Most of the time you get that lecture about how easy you have it compared to them.

"Chuck Yeager," my dad continued quietly, "broke the sound barrier the week I was born. From there on it was higher, farther, faster. By the time I was fourteen, when my dad was stationed at the Navy's test center at Pax River, I used to race the brand new F-4s down the taxiway on my bike." Dad smiled at the memories. "They trooped my entire eighth-grade class down to the auditorium to watch John Glenn blast off for orbit. My dad, your grandpa, was downrange with the recovery task force. He flew recovery for just about every one of the Mercury and Gemini shots." Dad's voice had risen with each sentence. You could feel his love for the dream. I think I knew where he got

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it from. He stopped and looked sidewise at me.

"You were born in 1975." He let out a long breath. "After the last Moon shot. The F-4s I used to drag race, well, the National Guard's still dragging them around the pattern at Portland airport. We've got new planes, but the new ones, the F-15s, the 767s, don't fly higher or faster." Dad was getting disgusted now. "Then, just when a boy needed something to believe in, NASA blew it, and you haven't had a dream for quite a while."

My dad stared sadly down at me. I nodded back. I think he understood me, as much as any grown-up could. That day it felt good to just soak in the knowledge that my dad tasted and respected my own pain.

"When I was a kid, all the trend curves were on a one-way trip to the stars." Dad frowned at the horizon. "Everything seemed headed up with no limits. We were traveling faster and higher each year. There were more people, more knowledge, more energy than ever before. Nothing was impossible, there were just some things we hadn't done yet." He glanced at me. "What have you grown up with?"

"AIDS," I shrugged, "nuclear accidents, Africa starving, and a space program that's going *nowhere*."

He grimaced. "The trend curves have kind of plateaued haven't they, Son? But they'll start up again." Dad's eyes pleaded with me to believe him, to trust his dream. I didn't feel like trusting anything.

"But Dad, that flat plateau is the only place I've ever lived. It's all I know." I didn't scream these words, not quite. They hurt Dad. He turned and walked to the other side of the sunroom. We both resumed our silent study of the ever distant horizon.

My dad was a labor negotiator. When we would get into a family problem with no ready solution, he had a tendency to "table" the issue. Put it on the back burner until he could come up with some idea. It drove me crazy. I wanted my problems solved now. As we stood there, watching the green waves pounding themselves to white against the unyielding rocks, I had a feeling I was about to be tabled. I was wrong.

"Son, what powered Jules Verne's *Nautilus*?"

"Huh?" Dad caught me off guard. I had to think for a second. "Uh, the power of the Sun, wasn't it?" The book *20,000 Leagues Under the Sea* might be science fiction, but it was ancient. I'd read it in school to avoid something worse.

"And what did Verne know about nuclear propulsion?" My dad's voice was eager, a tight smile was creeping across his face and he was clenching and unclenching his fists.

"Nothing." How many times had I heard dad tell this story before? Out of self-defense, I took it over from him. "Jules was guessing. He knew he needed a non-oxygen burning power supply for a true sub, and he knew the Sun didn't burn oxygen."

"Right." Dad grinned at how well I had memorized my catechism. "And when Rickover finally put it all together, what name was the only one he could give his sub?"

"The *Nautilus*," we said in a two-part harmony.

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"OK fellow, and when they're naming the first starship, what name will they have to give it?"

"The *Enterprise*. So what?" I snorted. "I'll be dead and my grandkids buried by then. Besides, the way things are going, it'll be named the *Yamato* or the *Lenin*." My dad didn't even bat an eyelash at my heresy.

"Son, what powers your *Enterprise?*" He was grinning like a card shark with five aces up his sleeve.

"Ah, antimatter?" From the look on his face, I knew he was up to something. That look promised fun. I was game to go along for the ride.

"Right, matter-antimatter annihilation powers the ship. A while back, *Aviation Week* magazine carried an article on a five-year study your United States Air Force funded to see if antimatter was just a science fiction writer's crutch. The air force got quite a surprise. Two years into the study they already had rapid, solid progress. With a little hard work and luck, in ten years they could be powering a shuttle as big as a 747 to orbit with antimatter fuel the size of two of those dice you use for Dungeons and Dragons. How's that?"

"How are they going to do that?" For a personnel type, my Dad subscribed to a lot of weird magazines. I'd been looking at the pictures in *Aviation Week* for years. About then, I was just starting to read it. I guess I missed that article.

"Well, the computers they've developed during your plateau are full of tricks and some real surprises." My dad sat down on the couch, and I joined him. There was no more morose staring at the horizon for us. The sparkle was back in his eyes. I hunched forward, bathing in his enthusiasm.

"Antimatter isn't something you mine, like coal. You make it. And with super computers, you can run simulations that will help you make it cheaply. They think they can use the new accelerator we're going to build to produce antimatter as a sideline. Then with superconducting magnets to hold the demons, you're in business."

"That could change the whole picture." I felt my heart start to beat faster. "You can't do any real stuff in space when nine out of ten pounds you're carrying at lift-off is just fuel."

"There's more, pal. In *2061*, Arthur Clarke mentions that Dr. Sakharov, now that he's out of internal exile, is working on a fusion-powered engine for spaceships." Dad was glowing by now.

"Dr. Sakharov," I knew him, he was a famous pain in the Kremlin's ass. Before that he had been . . . "Wasn't he the guy who invented the Russian H-bomb?"

"Son, he invented *The* H-bomb. We had to play catch-up once he showed us he could make a fusion explosive small enough to fit into an airplane. Now when you turn a mind like that loose on something good for the world, you tell me what's going to happen."

Years later, when the Sakharov drive made possible regularly scheduled service to our Mars bases, I said a prayer to the memory of that great Russian. Even his death had not dissolved the team he built. They followed his dream after he was gone. By the time his engines were plying space, I was finding my own place on a different type of team. It gave me encouragement to see

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what teams like my own could make real.

But that day at the beach, "Wow," was about all I could say. I stood up and looked out over the ocean. I felt a spark of hope that maybe those rocks would not have to wait two hundred years to see a real spaceman. But my father had one more trick up his sleeve.

"When did Jules Verne write about the *Nautilus*?"

I just shrugged. I had no idea.

"Well, let's see. The American sailing sloop chasing the *Nautilus* is part of the post Civil War navy. In *Mysterious Island* where we meet Nemo again, the heroes escape in a balloon from the siege of Paris in the Franco-Prussian war of 1870. Takes time to get a book published. Let's say Verne wrote it about 1867. When did the *USS Nautilus* signal it was under way on nuclear power?"

"Nineteen fifty-five, I think?"

"Close enough. How long did it take us to go from sail to steam to real nuclear power?"

I did the arithmetic quickly in my head. "Eighty-eight years." My dad smiled and nodded. He probably had the number worked out before I did.

"When did 'Star Trek' premiere?"

"Nineteen sixty-six." That was one date I was sure of.

"Add eighty-eight years to that, friend, and what do you have?"

"Twenty fifty-four!"

"You'll only be seventy-nine years old then. Not an impossible age to go to space, what with the advances we're making in medicine."

I'd be ancient was all I could think. "How am I supposed to get into space at that age?" I shrieked, jumping up from the couch.

"As I see it, you've got a couple of options. Make scads of money and foot the bill for the ship's construction." Dad was back to being very matter of fact again. "Heinlein had a character do that. Be on the research team that makes the breakthrough. They'd be glad to have you along. I'm sure there are other options. Just because you're young doesn't mean that us old folks can't have any fun."

"You're not old, dad. You aren't even forty yet."

He smiled, picked up his book and moved back to his favorite chair. "Think about your options, friend. We'll discuss your action plans during our sunset walk on the beach."

Dad was right and he was wrong. It was a whole different route that got me on the first starship.

I had a tough time with math in those days, and every job that led to space went through a lot of math. I got my Ph.D. in pharmacology and was part of the team that beat the AIDS virus around the turn of the century. Of course, none of the teenagers who rode up on the shuttle with me knew much about the AIDS epidemic. It was ancient history to them, just like the polio epidemic was ancient history to me at their age.

In my own way, I did my best to hook my son on space. I guess you'd say I got a bit heavy-handed. Somehow, by the time he was in college, we reached the stage where he'd say it was the Moon if I said it was the Sun. He went into selling insurance and real estate. I told him I couldn't think of a more

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worthless, less productive job for a man. And of course he proved me wrong.

He did right well at his chosen profession. And he knew how to use the money he made. His political contributions backed the right horses, which only infuriated me more. I always backed losers. When the candidate he backed big made it to the White House, he got himself an ambassadorship out of it, but not at some plush European embassy. He wangled an appointment as ambassador to the Global Security negotiations in Geneva. They'd been stalled for better than ten years. I thought he was just looking for good skiing.

But it was during his five years that new and different ideas made their way to the bargaining table—strange ideas from sources as divergent as Harvard professors and African tribal elders. Ideas that, when they were reworked, reworded and revised created the international machinery for resolving a broad range of differences between nations without them having to resort to force. But even more surprising, his team came up with options for resolving the conflicts brought on by the pluralism within nations. Again they were able to arrive at a global consensus on systems and procedures that people could use other than armed rebellion, and governments could apply other than bloody suppression. Even the Irish finally could settle "The Troubles."

He sent me one of the pens the President of the United States used to sign the Grand Treaty of Geneva. He included a brief note. "Now we can build your dreams," was all it said. He was right. Finally the nations could spend the money on research and space that humanity's future really called for.

I wasn't too old to learn that there is something harder than eating your words. It is leaving them left unsaid. I used his pen to write him back.

"You must have drawn on every ounce of skill you had to fashion that deal. You pitched it to the world, and they bought it. I can't tell you how proud you've made me and your granddad. I've rented a place at the beach for a week after Christmas. Could you make it?"

He did. I liked the man I got to know that week.

And that brings me to Ellen, my little granddaughter. While her dad was busy making his fortune, she would come visit me almost every summer. The first summer she came was about the time I got tired of being functionally illiterate in higher math. Television commercials were advertising a "Course of the Month Club," learning packages that combine interactive computer learning with some great visuals. I bought quite a few cubes, including the math ones. The people doing the teaching really were the leaders in their field and, what's more, they knew how to teach. It seemed like a light was turned on in my skull. Suddenly I was learning calculus. I had to laugh, though. At eleven, Ellen went through the math faster than me. I sent her home with her own set, and got a plea for the next level for her Christmas present. While I was digging in, she was off and running.

Of course, every summer afternoon at 4:00 we'd stop what we were doing to watch the Star Trek reruns. Those

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years they weren't being carried anywhere on cable, we'd watch them on disk. Ellen loved the new holo-ized versions. I preferred the flat originals. My dad's father had been there at the dawning of the space age. He had spawned four generations of space dreamers. With Ellen, we hit a gold mine.

After her Ph.D., I knew Ellen got involved in the research on irrational space, the first effort to squeeze practical applications out of the new Unified Field theory. Only later did I find out how much she contributed to the breakthrough needed for voice transmissions through irrational space. When she was appointed communications officer on the soon to be commissioned *Enterprise*, I was ecstatic.

From the few brief calls I got from her during the starship's working-up period, I knew she was going through a lot. I followed everything the media aired on their shakedown voyage to Alpha Centauri. The first snows had just begun to cloak Mount Hood when they returned. I was happily surprised to find a message from her the very next day. I immediately told Hal, my computer, to call her back.

Five minutes later, as I was screening my mail, the monitor went blank.

"Grampa!" There was Ellen, a beautiful sight for old eyes.

"Hi kid, I hear you've got a few miles under your belt now. Brought any trinkets back for the natives?"

"I think I got something better." She beamed.

"Interesting." I emphasized the word with my best imitation of a Spock-raised eyebrow.

"Grampa, we're having crew retention problems."

"Impossible," I interrupted her. "Who could walk away from such a dream billet?"

"Yeah, well, we'll talk more about that later." She shook her head to rid it of the deep frown that had flashed from the screen. "Anyway, Captain Ogilvie pulled a bit of history out of the wet navies. Seems the old US Navy tried to soften some of the family pressures on its men with what they called a Tiger Cruise. They'd bring the wives and kids of the crew aboard for a day to show them what their sailor men did, how important it was and stuff like that. Sometimes they'd take the older kids out for a couple of days. You know what I mean?"

I remembered some such thing. But more than that, I wondered why she was telling me. Slowly I nodded.

"Well, the captain announced that we'd be taking teenagers aboard next week for a three-day trip around Mars. No warp drive, just impulse power so to speak." I kept nodding.

"I asked the captain how old a teenager had to be." She paused. My skin broke out in chills. Quickly I blinked back the moisture starting to gather at the corner of one eye.

"Grampa, if you want to, officially, next week, I'm sponsoring you as my teenager. You want to come aboard?" ■

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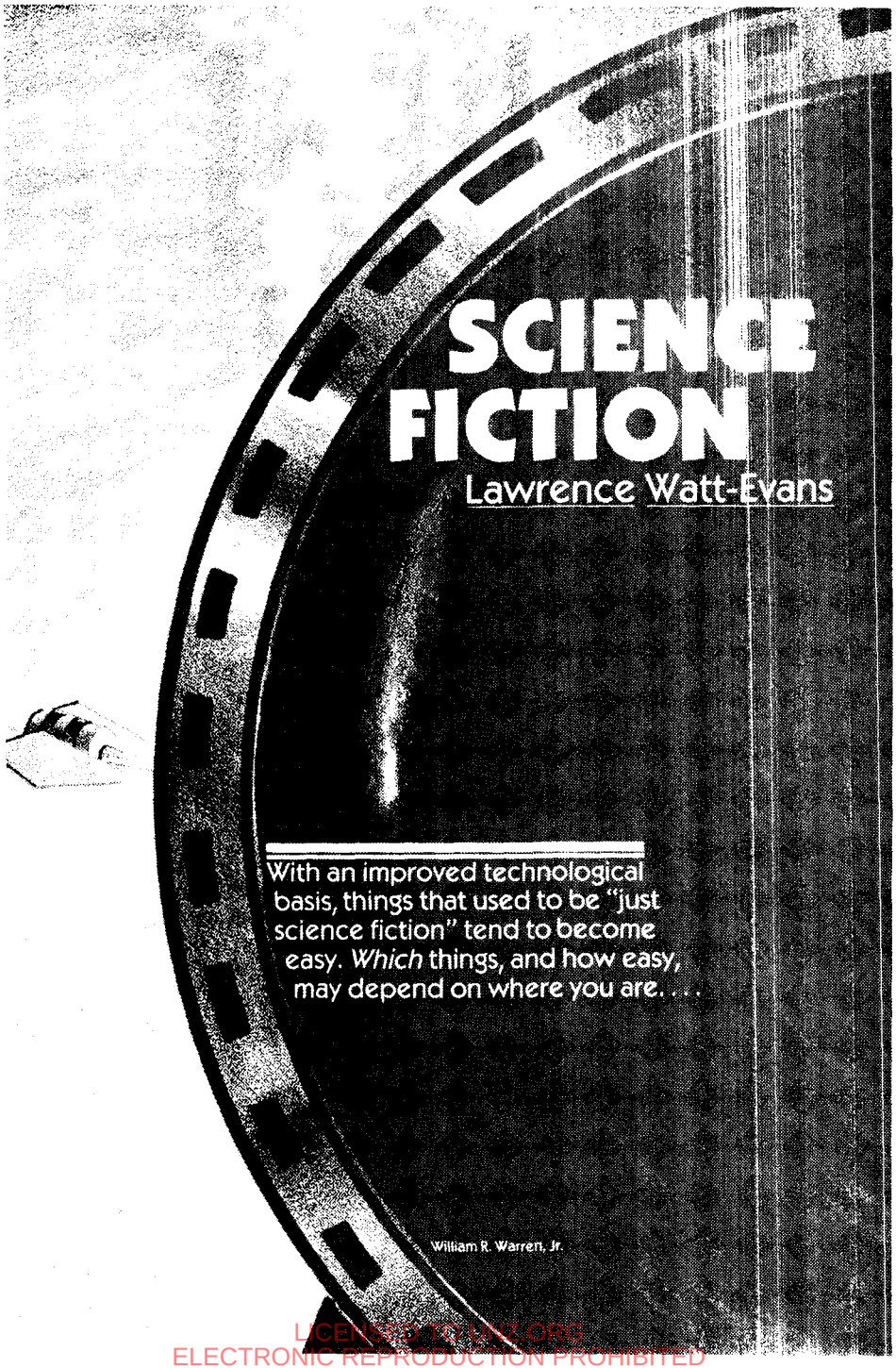

SCIENCE FICTION

Lawrence Watt-Evans

With an improved technological basis, things that used to be "just science fiction" tend to become easy. *Which* things, and how easy, may depend on where you are. . . .

William R. Warren, Jr.

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Jim looked up as Sandy poked his head in.

"*What're ya doing?*" Sandy asked.

"Reading," Jim said, holding up the book.

"Reading what?" Sandy demanded as he climbed into the old packing tube that served the boys as a refuge from their families and the outside universe in general.

"Science fiction," Jim said. "It's a real old book my mother found somewhere, about two kids who build a spaceship and fly to the Moon."

Sandy blinked. "What would they want to go to the Moon for? And how would they get home again?"

"The ship takes them both ways, of course. It's got some sort of special nuclear drive—it's called 'atomic propulsion.' "

"Sounds fake to me," Sandy replied, "Like the author was making it up."

Jim shrugged. "He probably was."

"So what did they want to go to the Moon for?" Sandy asked.

"Well, 'cause no one had ever done it," Jim answered.

Sandy stared. "Aw, come on," he said.

"Hey, I *told* you it was a real old book. *Real* old."

"It must be a hundred years old, if no one had gone to the Moon!"

Jim nodded solemnly. "About that, yeah."

Sandy was silent for a moment in awestruck silence. "You're reading a book a *hundred years old?*"

"Yeah."

"How'd it get here?"

"*I* don't know; my mother just found it somewhere. I guess somebody brought it along when they built the place."

Sandy started to accept this, then stopped. "Wait a minute," he said. "If this book is from before anybody even went to the Moon, then where are these two kids who build the spaceship in their backyard?"

Jim grinned. "On Earth," he said.

Sandy stared at him in disbelief for a moment, then snickered.

Jim snickered back, and in a moment both boys were rolling around the tube, hysterical with laughter.

"On *Earth*?" Sandy gasped, "Two *kids* . . . build a *spaceship* . . . in their *back yard* . . . on *EARTH*?"

Jim managed to stop laughing long enough to reply, "That's what it *says!*"

"But Earth's at the bottom of the biggest gravity well in the inner system! Except the Sun, anyway."

"I *know*, I *know!*" Jim replied, chortling.

A new wave of hysterics swept over them.

It took the boys several minutes to calm down, but at last they managed it, and lay quietly side by side, getting their breath back.

"Y'know," Sandy said, as he stared at the curving steel overhead, "I bet we *could* build a spaceship in my back yard."

"Sure," Jim replied, "If we wanted to. *We* aren't in any gravity well!"

"We could even launch it—my yard's right above the Number Three emergency lock."

Jim considered. "We'd need to put it on maglev or wheels or something to

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get it to the lock, though," he pointed out.

"That's no problem," Sandy said. "We couldn't go to the Moon, though. Or if we did it'd be a one-way trip, and probably a rough landing."

"No," Jim agreed, "But if we had maneuvering jets we could probably go to one of the other colonies."

Sandy nodded. "If they'd let us in. They probably wouldn't."

" 'Course not. We wouldn't have clearance from ISA. They don't allow direct flights between colonies."

"Why not, anyway? I never understood that."

Jim shrugged. "Me, either. My Dad says it's just politics. He's been to one of the other colonies—Shepard, I think it was. Had to go to Earth first, then back up. Seems stupid."

They lay quietly for a moment, and then Sandy said, "*I've* never been to any of the other colonies."

"Neither have I," Jim said, "I've never even been to Earth. But I was outside once."

Sandy lifted his head and stared at his friend in surprise. "You were?"

"Sure—just out on the shell, though. Mom took me along on an inspection tour once."

"Wow, neat."

"Yeah, it was."

"I'd like to see outside," Sandy said, lowering his head again.

Another silent moment followed, and Jim recovered his antique volume. Before he could find his place, Sandy remarked, "If we *did* build a spaceship, we could just cruise around a little, maybe do a single orbit, and then come back aboard. They'd *have* to let us aboard our own colony!"

Jim put the book down and considered.

"It'd be a neat thing to do," Sandy pointed out.

Jim had to agree.

At first Jim had hoped that they would be able to use the old book as a sort of guide, but that didn't work out; the descriptions in it were insufficiently detailed, and most of the equipment described was either totally fanciful or hopelessly outdated.

Still, he read it cover to cover twice. His father, in a moment's distraction from his work, noticed the flamboyant little volume.

"Where'd you get that?" he asked.

"From Mom," Jim told him.

His father picked the book up and looked it over curiously. "From Earth," he said. "Someone wasted part of his lift weight allowance on *that?*" He shook his head. "What an idiot."

This gratuitous remark rankled, and Jim made it a point from then on not to mention the spaceship project to anyone.

Work proceeded. The packing tube, hauled from the empty lot where it had been ditched to Sandy's yard, made a fine main hull. Jim bought a bubble of polarizing plastic from the colony's salvage dump; that would close off the open end when the time came.

Emergency oxygen tanks were easy to come by; the colony had them in every room and on every walkway corner, far more than the present population would ever need. The colony had been designed for a much larger population,

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but Earth had stopped sending volunteers, and natural increase still hadn't come anywhere near filling the available space.

It wouldn't any time soon, either, since the colony was short on necessities other than air and space, and meanwhile no one was going to miss an oxygen tank or two.

Jim had an old algae tank his sister had built as a school project two years before; he cleaned it out and restocked it. That would help with the air and provide a back-up food supply.

Both had their own pressure suits, of course. Everyone in Havel Colony had a suit. Jim and Sandy were well aware, as they sat on Sandy's back lawn, that under the oxygen-producing grass lay a few centimeters of topsoil, and below that about a half-meter of metal hull, and below that—nothing.

Nothing but the emptiness of space, emptiness where the occasional meteor or chunk of space rubbish stood a finite chance of whacking into the colony.

So everyone in Havel colony had a suit.

Neither boy was willing to risk his personal AI to provide an on-board computer, so Sandy's old nursery computer was brought out of storage and installed, with the operating system hot-rodded and with navigational software off the public net. Wheels, for maneuvering inside the colony, were provided by the simple means of bolting the boys' outgrown toy wagons to the handling loops on the packing tube.

The hardest physical labor in the entire project was levering the tube up high enough to work the wagons underneath; it took most of an afternoon.

Propulsion and steering were the big problems, though.

"All we need is something under pressure," Sandy said, as he lay in the partially-finished hull, his feet propped up on the algae tank.

Jim snorted. "Sure. Like what? We don't dare swipe any more oxy bottles, and those wouldn't last long enough to do any good, anyway—this thing we're building must weigh a tonne!"

Sandy didn't argue with that; instead he suggested, "Maybe we could *make* something."

Jim didn't bother snorting again. "Like what?" he asked.

"*I* don't know," Sandy admitted.

"We don't need pressure, anyway," Jim pointed out a moment later. "All we need is reaction mass and some way of throwing it. Doesn't have to be pressurized."

"How *else* are you going to throw it?"

"I don't know, but it seems like we ought to be able to rig up *something*," Jim replied. "Look, if we don't need to pressurize it, we can use any old thing—we can just take all the junk from the salvage dump that nobody wants, the stuff that would be going into the furnaces anyway. Then we just throw it away when we need to steer."

"Yeah," Sandy said, "But we're either going to need a lot of mass or a lot of speed, if we want to move the whole ship! Pressure's real good for building up speed. Stuff comes out fast."

"There are other ways, though. Suppose we put a piece of scrap on a big flywheel and spin it up? I mean, we're planning to use the colony's spin to

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launch in the first place, right? Why not do the same thing to steer?''

''I dunno,'' Sandy said. ''How would it work? I mean, how would you control what direction it went? How would you get something to stay on while you spun it up?''

Jim rolled over, blinking, then got to his knees. ''Let's see,'' he said. ''Well, suppose you had strings, with pieces of scrap tied to them, and when you needed to turn you tied the other end of the string to the rim of the flywheel. Then you'd spin it up fast as you want, and then cut the string as it went by.''

''When you spin the flywheel, the rest of the ship's going to turn the other way, you know.''

''Yeah, I know,'' Jim admitted. ''You'd have to allow for that. Shucks, you could *use* it—you could get yourself pointed in the right direction that way.''

''And how are you going to cut the string at exactly the right instant? How do you know the mass of the scrap you're using?''

Jim stopped and considered that with mounting annoyance.

''All right,'' he said. ''It wouldn't work. Not with anything the two of us could build.''

''Nope,'' Sandy agreed. ''I like the flywheel for rotating the ship, though—I think we should do that.''

''That's easy enough. A bike wheel with weights along the rim should do fine, and it can go inside with us.''

Sandy nodded.

For a moment they sat, thinking silently.

''What about a crossbow?'' Sandy said, suddenly. ''Or a catapult? Something with a spring in it? We can put a winding motor on it, and load it with a remote grappler—tie a big bag of scrap alongside, and when we need propulsion we just haul a piece out of the bag with the grappler, load it in the catapult, and let fly.''

''We couldn't put them on every side, though!''

''No, of course not. We mount one big one, on a swivel. Then we use the flywheel to rotate the ship to the right direction, the grappler to load the catapult and point it the right way, and there we are!''

Jim blinked, and tried to imagine such a thing.

''No,'' he said, ''You'd need at least two, because if there's only one you'll just wind up spinning around. You'd need to fire off two at once, on opposite sides.''

Sandy struggled with the physics for a moment, then nodded. ''I guess you're right,'' he said. ''So we build two.''

''They'd need to be balanced.''

''So?''

Jim had no direct answer to that. ''Even if it worked, it'd be awfully slow and clumsy,'' he remarked.

''So what?'' Sandy asked. ''We aren't going anywhere, just around the colony. Who needs speed? And we'll take a radio and call for help if it breaks down.''

Jim nodded, and grinned.

''It's going to look *really* stupid,'' he said, ''But I don't see why it wouldn't work.''

It did look stupid. When the catapults were built a tangle of machinery projected from either side of the hull at a ninety-degree angle. It looked stupid, and it also took months to scavenge the

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parts that could be scavenged, and save up enough to buy the parts that couldn't. Two radio-controlled remote grapplers with video hookups cost a good bit, and spring steel was also at a premium aboard Havel Colony just then.

When Jim first heard the prices for the steel and the grapplers he balked.

"I don't want to waste all my money on this! I mean, what good's this ship gonna be, really?"

"It'll be neat, Jim," Sandy said. "Really! Something to tell your grandkids, y'know? How you built your own spaceship?"

Jim relented, reluctantly.

Assembling the whole contraption was, like most engineering jobs, much more complicated and difficult than expected.

The project kept the boys busy enough that they didn't worry about the latest ISA rulings; they were probably the only people in the colony old enough to understand what was happening who didn't worry. They noticed that dinners were getting smaller and less interesting, and that prices on everything were rising, but with the self-centered confidence of youth they assured each other that everything would work out all right.

"It always does," Sandy pointed out. "I mean, nobody blew up the world back in the Cold War, did they? And the biocrisis got fixed up by the genetic engineers, right? It'll turn out OK."

"Sure," Jim agreed, remembering, but not mentioning, plenty of cases where things had *not* turned out OK for one group or another. Yes, the human race as a whole survived and flourished—but did Carthage? Or the Polish Jews?

Of course, those were a long time ago. Nobody had attempted genocide in half a century.

Not that wiping out the orbital colonies would necessarily even constitute genocide. And nobody wanted to wipe them out, Jim's father assured him. The ISA just wanted to bankrupt them, not kill them—force most of them to go back to Earth. The colonies were profitable, and the ISA wanted all that money for itself. If the colonists were to give up and go home, the factories and farms aboard could be automated and made far more profitable.

Jim didn't really worry about it, though—not when he was welding the grapplers onto the hull, or loading the bolted-on wagons with net bags of scrap, or testing the winding motors, or building catapult frames around their precious strips of spring steel.

He was far more concerned with getting the catapults to work. His test shots sent various debris sailing every which way, once putting a marble clear into the zero-gee zone overhead, so that it never came down at all, so far as the boys could see.

And Sandy wasn't even as worried as Jim. He paid no attention at all as he mounted the flywheel he had constructed out of an old bicycle, with lead scrap mounted along the rim where the tire used to be, or while bolting Jim's catapults onto their swivels.

It came as a shock, therefore, when Sandy's mother announced at dinner one night, "We'll have to leave."

Sandy looked up from his burger. "Leave what?" he asked.

"Leave the colony," she said. "Go back to Earth."

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"Back?"

She frowned. "All right, go to Earth, then. I know you've never been there. But it would be going back for me and your father—we grew up there."

"I know that. But why should we?"

"Because we can't afford to stay here any more, that's why. Look at what you're eating!"

Sandy looked. He didn't see anything very unusual about it. The burger didn't have any cheese on it, and there weren't as many french fries on the side as usual, but it looked OK. "What about it?" he asked.

"What about it? Sandy, this is the third night in a row we've had nothing but those damned fake burgers for supper!"

"Is it?" Sandy tried to see why this was important.

"Yes, it is! Because they're all we can afford! Maybe if we had our own garden we could scrimp a little and get by, but I don't have time to work a garden, and we don't have enough money for seeds or topsoil or fertilizer anyway, and what could we grow in the five centimeters of sod they gave us?"

"The Wangs have a garden," Sandy mentioned, and immediately wished he hadn't.

His mother exploded, and he excused himself and slipped out before she could work herself up to sending him to his room, or even slapping him.

He didn't make out much sense in the explosion, but apparently his mother had talked to the Wangs, and they weren't interested in sharing their garden.

He went to the spaceship in the back yard and crawled in. There wasn't anything in particular to work on in there, but it was somewhere to go.

He sat down on one of the cushions they had recently installed and began idly working one of the winding motors, cranking the catapult back and then letting fly, while he tried to think.

Leave Havel Colony?

That was a scary thought. He'd always lived here, after all. He was born in the very house he still lived in. And Earth? With the open sky, and the dirty air, and that stuff that fell out of the sky—rain, and snow, and wind? Where it got colder than a freezer in some places, and hot as blood in others?

He didn't think he would like that.

And he particularly didn't think he would like living there *forever*, never going anywhere else.

Could you see the stars from Earth?

Oh, of course you could—half the time, anyway. Some of them.

He looked around at the bizarre, jury-rigged spacecraft he and his buddy had assembled. They hadn't had a chance to fly it yet, but it was just about done. All that was left was a little debugging—there were bound to be plenty of bugs.

Speaking of bugs—they had bugs on Earth, not just the planned and engineered ones in the agricultural areas, but wild ones that could bite or sting. And they had diseases there, where your body would stop working right because there were parasites inside it trying to eat you alive—yuck!

He wanted to take the ship out for its maiden voyage before he had to leave, to get a good look at the stars. Would there be time? Or did Mom mean to leave right away?

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Why did they have to leave, anyway? Just because the ISA had raised prices? "Cutting the subsidy," they called it on the vid news—"passing on transportation costs."

Well, who asked the International Space Agency to do all the transporting in the first place?

Mr. le Beau, two doors over, always said that if the ISA didn't insist on doing all its own transportation and supplying all the colonies from Earth that there wouldn't be any problem. If they let private companies launch stuff up unmanned, instead of putting everything on the shuttles, or if they let the colonies trade directly with each other . . .

But that wasn't allowed. The ISA didn't want the colonists getting out of hand. They didn't really want the colonists here at all.

Sandy spun the flywheel. It whirled smoothly, with only the very faintest whirring sound.

Jim's dinner was more peaceful. Nobody shouted or ran off. Instead, Jim's father held forth in a long, heartfelt lecture, while Jim, his sister, and their mother listened.

They'd heard most of it before, of course.

There was one new element, though.

"They're cutting off our supplies of fuel, did you know that?" Jim's dad said, slapping a hand on the table. "They say it's too dangerous, storing large quantities of volatile materials up here. Dangerous! And it isn't dangerous having short fuel supplies for the stabilizing rockets? It isn't dangerous being so short-handed all the time, because they won't send up more people? They don't care about the danger, anyway—they're just worried that we'll start building our own ships up here, and break their monopoly!"

Jim looked up, interested. Building ships?

Dad was off onto something else already, though, something that didn't interest the boy.

Jim pushed back from the table. "Excuse me," he said. "I'd like to take a walk while my food settles."

"Go ahead," his mother said.

His father didn't seem to notice.

Jim wandered out the front door, then paused and looked around.

The prefab house shells stood in neat rows along the street, curving up in either direction until the circle closed overhead—at that distance they didn't look much like houses, just like little boxes. Half of them were empty and unfinished. Way off in the distance he could see some of the framework of the colony's solar reflectors, but the bright light made it hard to make out any details. The other end of the cylinder, with its offices and elevators and the access to the zero-gee zone in the colony's center, was much closer than the mirrors.

It looked very solid and comfortable, each house set in its lawn of genetically-engineered grass, designed and bred for maximum oxygen production. Someone had told Jim once that natural grass, back on Earth, was a different color, a much less intense shade of green, but he wasn't sure he believed it.

Under that grass were a few centimeters of earth, a fraction of a meter of steel, and then all the infinite void, spattered with stars and other bodies—and except for that one brief trip out onto

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the shell, long ago, he had never seen those stars with his own eyes. What good was living in an orbital colony if you never even saw the stars?

The kids in that book had certainly been eager enough to go adventuring, no matter how dangerous it was. And they hadn't had the advantages of a hundred years' experience in building spacecraft.

He turned and headed for the ship.

He was startled to find Sandy already there, crouched inside, playing with the flywheel.

"What's up?" he asked.

"Hi, Jim," Sandy replied. "It's my mom."

"What about her?"

"She says we have to go to Earth, that we can't afford to live here any more."

"What?" Jim exclaimed.

Sandy shrugged.

"Really? You're going to Earth?"

"I guess so, yeah."

"When?"

"I dunno—soon."

"Hey, that really sucks!"

"Yeah. And we didn't even get the ship out yet."

Jim looked around.

"We could do that, you know. It's almost ready."

Sandy blinked. "I thought you were still having trouble aiming the catapults."

"Not really; I've gotten pretty good." Jim flushed slightly. "I was just nervous, you know? Launching this thing's a big experiment. It could be dangerous. We could get killed."

"Yeah," Sandy agreed, "I guess so."

"If you're going to Earth, though—well, that sucks. I think we should take it out for a spin before you go."

"Yeah," Sandy said, thoughtfully. Then, more enthusiastically, "Yeah! Yeah, let's do it! Right now!"

Jim hesitated.

"Now?" he said. "Right now?"

"Sure, why not?"

Jim had no answer to that.

In point of fact, though, there were several last-minute things to be done beforehand—tying nettings across the heaps of scrap so they wouldn't come loose during launch, hauling stocks of food out from the boys' respective kitchens, and a great deal of checking things over.

Then they pushed the contraption across twenty meters of lawn onto the Number Three emergency airlock; it bumped down onto the bare metal of the airlock door, rolled a few centimeters, and stopped. The boys donned their pressure suits, and set their throat mikes to feed to external speakers, external pick-ups to feed to earphones. They ran through a final systems check—and discovered a small problem.

"How do we work the airlock from inside the ship?" Sandy asked.

Jim considered the situation, gauging distances by eye.

"If we set it right in the corner, here, and run the setup routine, and put everything on automatic," he said, "I think I can hit the cycle switch with the starboard grappler."

He fit actions to his words, typing the appropriate commands onto the airlock control panel; then he climbed aboard

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the makeshift spaceship and closed and sealed the hatch.

Sandy was already at the grappler's controls.

"Hey," Jim protested, "I was gonna do that!"

Sandy shrugged. "You did the preset, so I get to push the button."

He did just that.

With a rumble, the airlock cover began to slide out from under them.

At first it carried the boys' spaceship with it, but in a moment the craft bumped up against the edge and stayed there, the wheels turning and squealing as the door slid along underneath. The wheels were not aligned exactly at right angles to the door's movement, which created the squealing and also caused the ship to creep slowly along, sideways along the edge of the airlock.

Then the edge of the door passed the first of the eight wheels, and the ship wobbled slightly.

Another wheel, and a shudder ran through the vessel.

"I just thought of something," Jim said, his expression worried.

"What?" Sandy asked, grabbing at the flywheel for support as a third wheel came free and the ship began to lean noticeably.

"We're going to drop down into the airlock at the equivalent of just over one gee, aren't we?"

"Um . . ." Sandy said, "Yeah, I guess we are."

The fourth and last wheel on the forward wagon came free, and the ship toppled over until it hung from the next pair of wheels. Every loose object aboard, including the two-man crew, plummeted into the plastic bubble that served as a nose. The algae tank sloshed noisily, but the seals held, and it and its contents stayed put.

The entire assembly then hung, swaying back and forth, as the door continued to retract.

Then the door vanished into the frame and the converted packing tube tumbled down into the body of the airlock.

It crashed against the outer door with a deafening metallic noise that left Sandy and Jim unable to think or hear as they tumbled about.

The craft did *not* land on its wheels or right itself; it struck nose-first, bouncing on the plastic bubble, rocking for a moment, then falling heavily onto its back.

Fortunately, no catapult or grappler had been mounted on what had been the ship's top.

The boys lay in their tiny cabin, stunned, as the inner door began to slide closed again above them.

"Uhh . . ." Sandy asked, still slightly dazed, "What did you set the auto cycle for?"

"Ten seconds," Jim answered, holding the side of his head where it had whacked against the inside of his helmet when the helmet struck the hard metal of the tube.

"Shit," Sandy said.

"Why?" Jim inquired, without looking at his comrade.

"That's not time enough to get out and abort it."

Jim glanced out through the bubble and saw nothing but the metal walls of the airlock; the door overhead was almost closed, and most of the illumination now came from the airlock's own internal lights—which were a dull or-

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ange color, and not the natural bright sunlight of the colony's interior.

"I guess not," he said. "Why would you want to?"

Sandy let out an exasperated sigh. "To see if anything busted when we fell," he said. "Like the seal on the hatch."

Jim looked at the bubble again. "It *looks* OK," he said uneasily.

A loud hiss came from outside as the lock's atmosphere was either pumped out or vented—neither boy knew which. It faded quickly to silence.

"I guess we'll find out in a minute," Sandy said.

With a rumble, the outer door began sliding away beneath them.

This time the ship wasn't on its wheels, so it didn't roll; instead it was pulled to the side of the lock, where it clanged against metal. As the door continued to pull, the ship was twisted around until it was flush against the airlock wall; again, fortune favored the enterprise, and the catapults and grapplers weren't crushed. The airlock door dragged its way under the little ship's hull with a shuddering vibration that Jim feared would shake loose every bolt or wire that hadn't been jarred loose in the crash.

"We didn't plan this very well," he remarked.

Before Sandy could answer the door slipped away, and with a final bump of uncertain origin the tiny spaceship fell out and away from Havel Colony.

The instant contact with the airlock was lost, the instant of that final bump, silence fell, total and startling. To each boy it seemed as if he had suddenly gone deaf—and then a moment later realized he hadn't, that he could hear his own breathing, the blood beating in his veins.

"Well, nobody thinks of everything," Sandy said. "Except maybe the guys in that book you read."

Before Jim could reply the view outside the bubble caught his gaze, and he stared out at the stars, stars brighter and more numerous than he had ever seen them, ever imagined them.

Then he started giggling, just slightly at first, but finally in uncontrollable gusts.

Sandy, without knowing why, joined in.

Jim reached up to wipe his eyes and found himself slapping the faceplate of his suit instead, triggering a whole new round of hysteria. It also sent him bouncing around the ship, since they had been weightless from the instant they left the airlock.

Weightlessness was not new to either boy—they'd both taken several trips to the hub over the years—but it added to their hilarity.

Finally, however, the two boys managed to calm down.

"We not only didn't think of everything," Jim said, "We hardly thought of *anything!* I mean, we didn't even name our ship!"

"That's right!" Sandy exclaimed. He looked around the tube, at the algae tank glued to one section of wall, the flywheel bolted to another, while tools, cushions, their on-board radio, the computer, the controls and video monitors for the grapplers, and dozens of other objects drifted freely and randomly about. A haze of dust and debris filled the air. A conic section of sunlight

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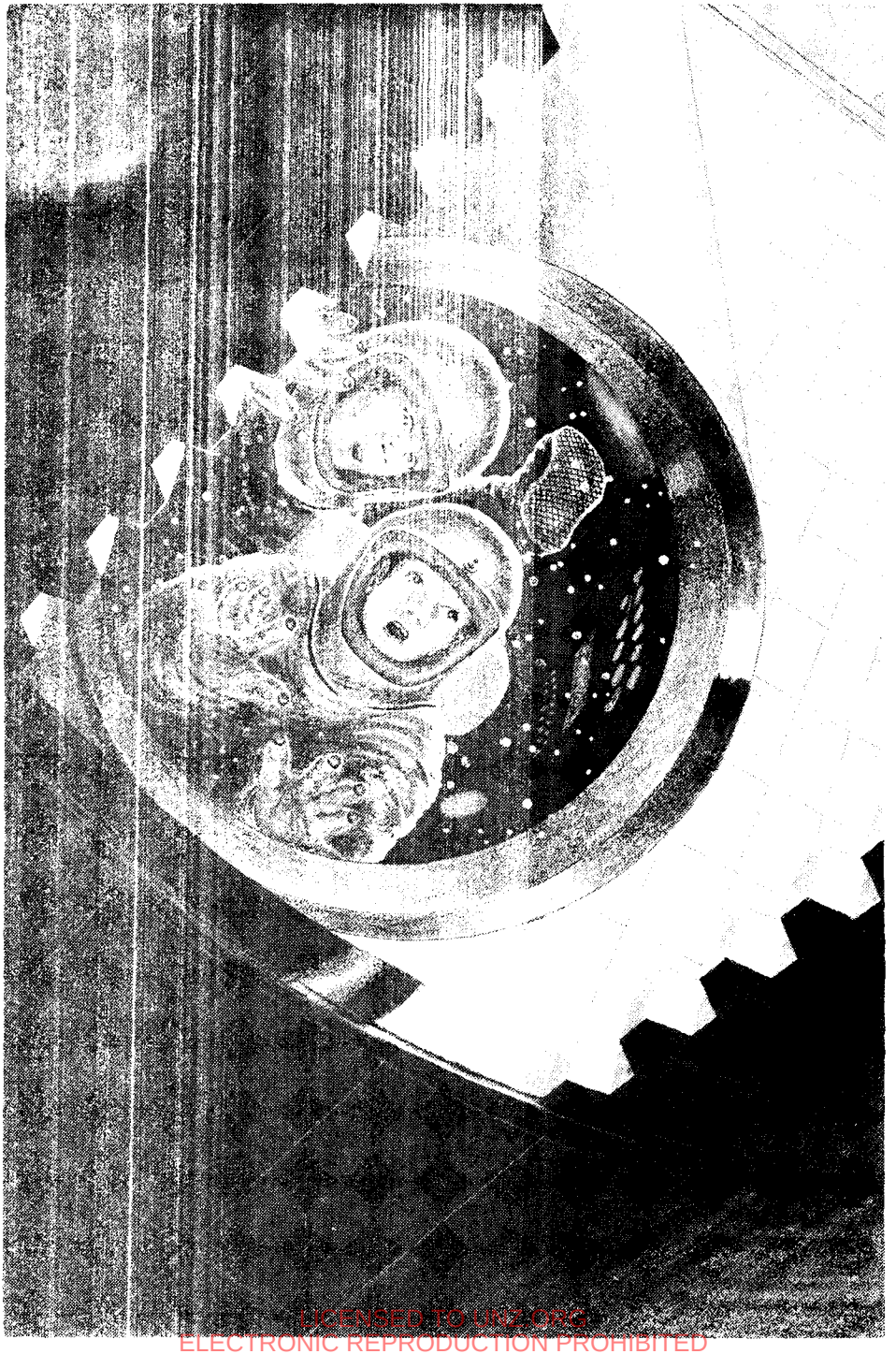

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blazed across one side, pouring in through the bubble at an angle; it moved around the cylinder, shortening and lengthening, showing that their little craft was tumbling through space. The boy thought he could hear a faint hissing, as if some of their air was escaping, but it might have just been the sound of his suit's systems going about their business.

"I hereby dub thee the I.S.A.S. *Mistake*!" he announced.

"Hey, no," Jim protested. "We're not I.S.A.S., we're an independent—the I.S.S. *Mistake*, Independent Space Ship!"

Sandy grinned. "Right!" he said. "My mistake!"

Jim smiled back, but did not laugh. Their previous bout of hysterics had been sufficient, and besides, the reality of their situation was beginning to sink in.

"OK," he said, "I.S.S. *Mistake*, James Iovino and Szandor Bardossy, co-captains, current location—where? Where the hell are we?"

Sandy shrugged. "I don't know," he said. "Somewhere near Havel Colony, in cislunar space, I guess. Take a look."

Jim looked, but could make no sense of the starscape wheeling past the bubble. He located a grappler console, snared it, and turned on the video.

That gave him a lovely view of the portside catapult, but nothing else.

He worked the controls and swung the little claw outward; all that gave him was a view of stars sailing by far too quickly to be identified.

"Use the flywheel," he said. "See if you can slow us down."

"Right," Sandy agreed. He thought about removing his pressure suit, for ease of work, but decided to play it safe—even if the seals had held so far, that didn't mean they always would.

He looked out the bubble, checked the drive chain to make sure the flywheel would be spinning the right way, and began working the crank that had once held a bicycle pedal.

The parabola of sunlight gradually slowed in its movement around the interior of the ship, but did not stop, even when Sandy had worked the flywheel up to the maximum speed its bearings would permit.

Sweating inside his suit, he released the crank.

"Best I can do," he said, apologetically. The cylinder was still turning at more than half its initial speed.

Jim nodded. He was already at work with a grappler, trying to load an irregular chunk of steel scrap into the bucket of the portside catapult. "That was a rough takeoff," he said. "I'll try and reduce the spin and the wobble, and then you can take a look out the bubble, see if you can spot the colony so I can head us back."

He turned the catapult on its swivel, doing the best he could to judge the direction of the ship's movement, and then hit the release.

The spring steel whacked against its frame, sending the chunk of debris off into the void, and with a slight jar the ship's motion changed. Sandy looked at the bubble; the sky beyond was still turning, but he thought there was some improvement.

"Hey, Jim," he said uneasily, "What if one of those things hits somebody?"

Jim looked at him, then back at the

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grappler's video monitor. "Um . . ." he said. "Well, it isn't very likely. If they hit Earth they'll just burn up in the atmosphere, which I guess won't hurt anybody, and there's an awful lot of empty space out there. I doubt they'll hit anyone." He shrugged. "I guess we'll just have to hope they won't. I mean, it's no worse than meteors or the debris from all those old probes, is it?"

Sandy nodded. "I guess you're right."

Jim didn't answer; he was reloading the catapult.

It took twenty-two shots, by exact count, and another cranking of the flywheel, before the ship's rotation was slowed to a manageable level.

Jim looked about uneasily.

"What's the matter?" Sandy asked.

"That took a lot of junk," Jim replied. "About a fourth of what we started with. I must have underestimated the ship's mass pretty badly, or overestimated the catapults' force." He shoved at the flywheel crank in annoyance. "Find the colony, will you? I think we'd better head straight back."

Sandy nodded, and launched himself gently toward the nose, catching himself just before his faceplate smacked against the plastic.

He looked out at the Universe.

To one side he could see the Earth, a gigantic blue crescent, the dark within the crescent's curve sprinkled with yellow dots of light that he knew were cities, though he had trouble imagining just what a city could be like.

About 150° around from that was the Moon, a half-circle white as death.

And the Sun was out there, too, at an angle he couldn't judge, because he dared not look directly at it. The bubble had no shielding, and he didn't trust his suit's faceplate to handle the full radiation.

Nowhere could he see Havel Colony, or for that matter anything man-made except those tiny golden lights.

He knew what the colony looked like; he'd seen plenty of pictures of the outside, the great cylinder with its docking complex at one end and its intricate array of solar mirrors at the other.

He didn't see anything like that out there now.

"I don't see it," he said, feeling his chest tighten as he spoke.

"Let me look," Jim said, scudding forward.

Sandy dropped back out of his companion's way and hung more or less motionless, waiting.

Jim looked for a long, long time before admitting, "I don't see it, either."

"What do we do now?" Sandy asked.

Jim chewed his lip. "It might be off that way," he said, pointing astern. "We couldn't see it then."

"So we should turn the ship around."

"Yeah," Jim said, "But that's not gonna be easy."

Sandy's nerve broke. "Oh, shit, Jim," he said, his eyes tearing up, "We're gonna die out here, aren't we?"

"Nah," Jim said, his own voice not terribly steady. "I mean, we brought a radio; we can call for help."

Sandy brightened, his tears stopping, at least for the moment. "That's right!" he said. "Why aren't we using it?"

"Because if they have to send a rescue party out after us we're gonna be in really big trouble, that's why! I want to get us back under our own power, if I can."

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Sandy looked at the radio, and then at the bubble, where the stars continued to move in slow arcs.

"Maybe we could use it to home in on the colony, without telling them we're out here?" he suggested. "See, when we're pointing one direction the signal would be stronger?"

Jim glanced at the bubble and then shrugged. "It might work," he said, "I don't know. Won't hurt to try."

He turned on the radio, receive only, to the colony's exterior traffic frequency.

". . . Oh, damn it, they're not listening. They probably didn't even take a radio, those fool kids!" someone was saying.

Jim and Sandy looked at one another.

"Does he mean *us?*" Sandy whispered.

The radio muttered for a moment as someone spoke outside the effective range of the microphone on the other end. Then the voice returned.

"Jim, Sandy, if you're listening, can you signal? We've got you on radar, but we don't know your condition. Jim, Sandy, are you listening?" The voice let out a loud sigh. "Damn fool kids."

"They know it's us," Sandy said, his eyes wide.

Jim frowned. "Yeah," he said. "I guess they must have gotten some kind of signal when we went out the airlock, and it wouldn't be hard to figure it out after that."

"What are we gonna do?" Sandy's moment of panic had passed; he was no longer worried about dying, only about staying out of trouble with the colony authorities.

"Maybe we should call, tell 'em we're all right," Jim said, looking about as if hoping to find useful information somewhere in the drifting dust.

"Yeah." Sandy agreed, "I think we should."

Hesitantly, Jim pressed the SEND button.

"Havel Colony, this is Jim Iovino, co-captain of the I.S.S. *Mistake*," he said. "We're both fine, but we're having a little navigational difficulty."

"A *little*—" Sandy began, but Jim shushed him.

For a long moment there was no answer, but at last the voice replied, "I'll be damned. You're OK?"

"Yeah, we're fine," Jim said. Before he could say anything more the voice on the other end interrupted.

"Navigational difficulties? What kind of navigational difficulties?"

Jim looked at Sandy, who shrugged. Jim shrugged back and said, "Well, frankly, Havel Colony, we had some trouble when we launched, and we don't know where the heck we are."

After another pause, the voice replied, "That figures." She sighed again. "You're about forty kilometers away, with a relative velocity of about eight meters per second; your current course will put you in a long elliptical orbit around Earth, about a forty-hour period. You'll get low enough at perigee for braking effects, so the orbit's not stable."

Jim and Sandy looked at one another.

"I never thought about that," Jim said.

"There's a whole *bunch* of stuff we didn't think about," Sandy replied.

"Maybe we should give up and ask them to send out someone to get us."

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Sandy looked around.

The air in the ship was dirty; the spin had thinned some of the particulates out of the air for a time, but since they had slowed the spin down and bumped the ship around in doing it, all manner of dust and slime and crud was now drifting about. The algae tank appeared to be leaking slightly; a thin mist was emerging from one corner, adding to the mess. Sandy saw now why real spaceships always had vents and filters and blowers, and wished they had some way to move the air around. A regular household air cleaner, like the one in his mother's kitchen, would have done fine. Without it, the shipboard environment was not very pleasant.

They had undoubtedly forgotten other things, as well.

The kids in the book hadn't forgotten any little details like that—but that was science fiction, Sandy reminded himself, not real life.

One of the grapplers was pointed toward the wagonloads of debris that served as fuel, and the video screen showed a distressing empty space where some of that fuel had been before they threw it away.

And the view out the bubble didn't include the colony, even though it was only forty kilometers away.

"Yeah," he said, "I think we should."

Jim pressed the SEND button. "Hello, Havel Colony," he said, "I think we're in trouble out here. Can you send a rescue?"

"Negative, *Mistake*," said a new voice, a masculine one this time. "You're on your own for the moment. We have nothing spaceworthy aboard, and no reserve fuel."

Jim looked up from the radio; Sandy's expression was grave.

"Now what?" Sandy asked.

Before Jim could respond, the radio said, "*Mistake*, do you boys have maneuvering capability?"

"Yes, sir," Jim answered, "But it's not very precise."

"Hm. I was thinking that maybe you could intercept Atanasoff Colony, but . . . how are you fixed for air and water?"

Jim and Sandy exchanged glances.

"I'm not sure, sir," Jim admitted. "We're not running short of anything yet." He hesitated. "Please, sir," he said, "We'd like to come home, but we can't *see* it. We ought to be able to, if we're only forty klicks out!"

"You sure ought to. Take another look, all around."

Sandy tossed himself into the nose and did just that. "Still nothing out this way," he called.

Jim frowned, and swung a grappler to point astern. He wished the video lens had a wider angle. He studied the starscape.

"If it's any help," the voice from the radio said, "We're in Earth's shadow right now, so it's probably pretty dark. We went in about an hour ago."

That information was what Jim needed; he swung the grappler and shrieked, "I see it!" Then he calmed and said, "At least, I think I do. There's something occluding a patch of stars there." He left that grappler where it was and reached for the other set of controls.

A moment later he had both catapults cranked back and loaded, and aimed

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directly forward. He knew he would need to adjust course later, but right now he just wanted to make a start.

He tripped the releases, and two chunks of metal sailed off into empty space.

He started to reload, then paused. "Havel Colony," he asked, "Are you tracking us?"

"Of course we are, Jim," answered the voice, the original female one again. "What kind of stupid question is that?"

Jim ignored the annoyance and said, "We just fired our main drive, such as it is—you guys see any change?"

A moment later the radio said, "Not much. Possibly a slight decrease in relative velocity."

Jim frowned, and reloaded.

A dozen shots later the woman on the other end acknowledged, "You've killed about half your relative speed, but you've added a little drift, too—your trajectory's changed."

Jim continued loading, aiming, and shooting. The aft wagon was now almost empty, and he began to use the forward fuel supply instead.

An hour later Sandy was curled up in mid-air, trying to sleep, and the *Mistake*'s fuel supply was reduced to half a dozen large chunks and a scattering of little bits. Jim was hot and sweating, despite his suit's temperature controls, as well as hungry and very thirsty.

And the *Mistake* was on course to intercept Havel Colony, or at least pass very close—but with a relative velocity of scarcely two meters per second, with fifty kilometers of intervening space.

That meant seven more hours of travel time. Jim didn't dare use any more fuel. It was becoming impossible to match the loads in the two catapults, which meant each shot was likely to make the craft wobble or spin, and they might need to maneuver later.

He looked around, and checked his suit readouts.

The helmet sipper was empty; the water recirculation wasn't working properly. And they hadn't brought any plain old water.

Their supplies did include boxes of synthetic fruit punch, though. Jim considered the fog of debris and concluded that the ship must be holding air just fine; he found a punch box and then popped his faceplate.

Hot air blasted in at him, and the accumulated stench made him gag. The ship was obviously gaining heat from the sunlight much faster than it could dissipate it, and Jim realized they hadn't even thought to bring a thermometer. Their suit refrigeration systems must be working near capacity, which would, of course, be adding to the heat in the ship.

He had never thought about heat buildup, all those weeks they were assembling the ship. The kids in the book thought of everything—but he and Sandy were only human.

Something stank horribly, probably something that had leaked from the algae tank—or perhaps some of the food supplies had gone bad in the heat. He almost lost interest in the punch, but he forced himself to jab the pointed straw into the foil circle.

Punch squirted out, adding to the floating mess, and Jim quickly clamped his lips around the straw.

When he had finished, he stuffed the empty box into the food bag, wiped

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away sweat, closed his faceplate, and joined Sandy in trying to sleep.

"Hey, boys, wake up!"

Jim started, an arm flying out and bumping a wall, sending him spinning in the opposite direction. He steadied himself and looked around, remembering where he was and what his situation was.

The sunlight was gone; the ship was dim, lit by starlight, the grappler video screens, and various gauges and pilot lights.

Sandy was stirring, rolling and bounding along one side of the tube; Jim didn't worry about him. He made his way to the radio as the voice called, "Can you hear me out there?"

Jim punched SEND.

"We hear you," he said, "What's up?"

"Not you," the voice said. "You're coming down fast. We estimate you'll make your closest approach to the colony in about twenty minutes, and we thought that you might want to try and adjust your aim. We've got people suiting up, and they'll come out on tethers to try and bring you in, but you'll have to get within 100 meters or the lines won't reach. We estimate you'll be about 120 out if you don't change course."

"Oh," Jim said, a bit sleepily, and then, *"Oh!"* as the situation sank in.

He began working the grapplers.

The colony was now plain on the video screen for the portside grappler; it gleamed pale blue in the scattered starlight, a gigantic cylinder so big that only a small fraction would fit on the screen at a time. As Jim watched, a row of golden lights blazed, sharp and clear and perfect in the vacuum of space; an airlock was opening.

He had both catapults loaded; he tripped the switches.

The loads weren't even; the ship turned toward the colony, but it was rotating anew, a slow, graceful roll.

Jim hissed air through his teeth and began reloading, making sure that the heavier load went on the starboard side, so as to slow or reverse the spin.

When he had the catapults loaded again he swung the grapplers out and looked for the colony.

There it was, and he could see tiny figures emerging, their helmet lights white, the brightest things on the screen.

Then the *Mistake*'s new rotation carried the video pick-up around, and Jim concentrated on his aim.

The catapults fired, and the ship had a new motion, a sort of corkscrewing.

It was also headed more directly toward the colony.

Jim hit SEND as Sandy studied the video screens. "How're we doing?" Jim asked.

"Better," the now-familiar voice said. "We estimate pericolony at 105 meters, and too far around the curve for the lines we're using. Keep trying."

Jim swung a grappler down and looked in the fuel bin that had been his express wagon.

Two more lumps of scrap—and they didn't even match. After that, nothing but steel shavings and plastic shards.

The kids in the book never had problems like this.

Damn that book, anyway. He should have known that any book that talked

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about building a spaceship in a backyard on Earth was nonsense right through.

He loaded and fired, and then waited, doing his best to keep both the video pickups pointed toward the colony as the *Mistake* rolled crazily through space. The spacesuited figures had grown from dots into human beings, and he could even see the writing on their helmets, glimpse bits of face through the transparent faceplates.

"Pericolony, eighty-five meters, in two minutes," the radio said.

Sandy drifted up to the nose to see what he could make out. Jim glanced after him, his pulse racing and his skin crawling with sweat; when he looked back at the video screens the portside view was of an immense hand reaching toward him, like a shot from an old horror movie, and he let out a startled yip.

Then he felt the whole ship lurch slightly as the hand closed firmly around the grappler's "wrist." Another hand grabbed the catapult frame.

"Got you!" said a new voice, over their suit intercoms.

Jim let his breath out, realizing for the first time that he had been holding it.

"That was an incredibly stupid thing to do," Jim's father said, as he and the boys stood at the mouth of the airlock, looking down on the battered I.S.S. *Mistake*. One grappler had been crushed and a catapult frame bent getting her back aboard the colony, and the plastic nose bubble had had to be smashed to get the boys out.

"I know," Jim agreed.

For a long moment the three of them stood, silently considering.

"On the other hand," his father said, "I'd say that it did serve as a good, practical demonstration that spaceflight's possible without rocket fuel, if you're not at the bottom of a gravity well."

Jim and Sandy both looked up at him, startled.

"This is just me making guesses, you understand," Iovino continued, "But I think that the ISA is going to have a few surprises in store for it, when people have had time to think this over. I've been thinking about it for eight hours now, ever since I found out you two idiots had gone out that airlock. I'd guess that in a few months, maybe a year, we'll see inter-colony trade established, without any necessity for trips down to Earth, now that you boys have shown us we don't need Earth-built equipment to survive out here."

"Won't the ISA object?" Sandy asked.

"Probably," he replied. "They might even cut us off, and we could have some rough times up here. These colonies were deliberately designed not to be completely independent—the Earthpeople were playing politics, scared of what might happen up here. But the colonies are all different, and I think what each one lacks, another can make up—if we have some way to reach each other."

"I don't know, Dad," Jim said. "The catapults didn't really work that well."

"So maybe we won't use catapults. Maybe we'll use solar sails or some other system. People have dreamed up plenty of ideas over the last century; it's just a matter of finding which one works." He shrugged. "Not your problem any more, boys."

He gave the *Mistake* one last look, then turned away.

"Let's go home," he said. ■

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OOPS!

F. Gwynplaine MacIntyre

Herr Doktor Professor Fallopius Fitch discovered a wonderful Theory *which* explained in precise mathematical terms the Meaning of Life and the purpose of germs. It also explained, in a few simple words, the light of the stars and the language of birds.

"All shades of the spectrum, whatever their pitch, fit into my Theory!" cried Doctor Fitch.

And that wasn't all: every fish in the sea fit right into his Theory, neat as could be. Doctor Fitch's great Theory clearly explained why the galaxies formed and the crescent Moon waned. And black holes, quarks, and quasars—gigantic or small—were explained by his Theory, once and for all.

"Each quantum of Space-Time has got its own niche in my marvelous Theory!" cried Doctor Fitch.

But then Doctor Fitch very suddenly saw that his wonderful Theory had a slight flaw: it explained the whole Cosmos with nary a hitch, *but his Theory couldn't explain Doctor Fitch!*

"A mere detail," he said, "which is easily missed." Then he published his findings, and *ceased to exist.* ■

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the reference library

By Tom Easton

The Illegal Rebirth of Billy the Kid, Rebecca Ore, TOR, $?, ? pp.
Raising the Stones, Sheri S. Tepper, Doubleday Foundation, $19.95, 454 pp.
Orion in the Dying Time, Ben Bova, TOR, $18.95, 356 pp.
The Rowan, Anne McCaffrey, Ace-Putnam, $19.95, 335 pp.
Take Back Plenty, Colin Greenland, Avon, $?, ? pp.
Maps in a Mirror, Orson Scott Card, TOR, $19.95, 675 pp.
Zenith 2, David S. Garnett, ed., Sphere Books (Orbit House, 1 New Fetter Lane, London EC4A 1AR), £3.99, 320 pp.
The Orbit Science Fiction Yearbook 3, David S. Garnett, ed., Futura (Orbit House, 1 New Fetter Lane, London EC4A 1AR), £4.99, 361 pp.
The 1990 Annual World's Best SF, Donald A. Wollheim, ed., DAW, $4.50, 341 pp.

Rebecca Ore got off to a beautiful start with the trilogy she began with *Becoming Alien*. Her concerns were the pain of being different, the need to fit in, the need to accept others, xenophobia and xenophilia. In the course of her three-volume discussion of these things, she used the idea that the way we react to others and to the world around us may literally be wired into our brains, thus making it exceedingly difficult to learn new ways of seeing and being.

It thus should not surprise you much to find very similar ideas and concerns cropping up in her fourth novel, The **Illegal Rebirth of Billy the Kid**. The time is the mid-21st century, when genetic engineers have developed their technology to the point where animal tissue can be rebuilt in human form to provide sex-toys and other "chimera" playthings. The CIA engages its own engineers to build duplicates of defectors that can be put back into the defectors' home niches to serve CIA ends. One of these engineers, Simon Boyle, chooses to steal raw materials and com-

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puter time to build a physical duplicate of Billy the Kid. Furthermore, he so programs Billy's brain that he sees only a reality that is consistent with Billy's historical life; that is, Billy is blind to 21st-century architecture, vehicles, gadgets, and clothing.

Billy functions perfectly well as long as Boyle keeps him in a suitable environment, and Boyle has no intention of doing otherwise. He rents Billy out to rich women who want to sleep with a famous outlaw. Billy sees them as one of his historical lovers and performs appropriately. But then Boyle, visible to Billy only as Pat Garrett, reenacts history by shooting him. Once he is dead, Boyle revives him, puts him back in the regeneration tank, and waits for the shooting damage to heal before running him through the scenario again for another woman.

And so it goes, until one of the women steals Billy before he can be shot. He is now loose in a world he cannot see and in which he cannot function, thanks to the rigid programming of his brain. But he's adaptable enough, and he makes it to the Albany SPCA, an agency that does for chimeras much what similar agencies currently do for the homeless. Here he meets Jane, and here the CIA finally tracks him down. It wants to know the identity of his "maker," and it seems all too ready to betray him—much as government authority betrayed the historical Billy—and even to kill him in its search.

Jane and Billy flee, winding up in a cultural park where the lifestyles of 1960s back-to-the-landers are preserved. Here is a reality that can serve Billy as a sort of halfway house. Yet the CIA remains, and they must come to terms with its demands before they can be left alone to get on with their lives.

I found most of the story interesting, absorbing, and quite well done. The ending, however, did not satisfy me. Ore seemed to be trying to shift her theme into something like the search for the Good Old Days, "something to be happy about," and while interest in old-time outlaws and back-to-the-land lifestyles might fit that theme, the shift undercut her larger concern with hard-wired perceptions.

It will be very interesting to see what she comes up with next.

Sheri S. Tepper's **Raising the Stones** begins so slowly and methodically that for a while I thought I would have to give up on it.

I shouldn't have doubted. Tepper has as sure a story-telling hand as you will find in America today. That slow beginning—describing the world of Hobbs Land and its flat terrain, unexciting, boring, and dreary but ideal for the purpose (raising food for the many other worlds of the local System) to which it has been assigned; the turniplike natives that died out shortly after the human settlers arrived; the strangely lumpish God that hung on for thirty years before following its worshippers; the pacific, gentle settlers who are most of the story's characters; the settlers' matrilineal society—is there for a purpose. As the texture of Tepper's imaginary world thickens, it grows exceedingly convincing. It doesn't take long for the reader to decide that here is a science fiction version of rural small-town America and its homey values[1] and to begin to like and care deeply about the characters who, though they are not violent or ambitious or prone to glorious displays of melodrama, still have their quirks and histories.

[1] Ray Bradbury, of course, mined a good measure of his fame from the same lode.

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And those histories! Some of the characters come from the land of Voorstod on the world of Ahabar. The Voorstoders are an amalgam of the old "retributive" religions—Islam, Catholicism, Calvinistic Protestantism with a strongly South African flavor—which merged after humanity left Earth. Only their men are important, their women treated little better than beasts or slaves, important only for the sons they bear. And they love pain and death; indeed, they believe their divinely appointed destiny is to kill everyone else, and the sooner the better.

This is what Maire Girat, a singer famous as the "Voice of Voorstod," escaped when she came to Hobbs Land. It is thus the background for Sam, her son, who feels robbed of the father Maire fled, who seeks identity in legends of the past, who wanders outside the village and talks to a phantom Theseus. And when the Voorstoders decide that they need to get Maire home again, to use her songs to keep other women from fleeing (and thus robbing the men of sons) or, if she will not cooperate, to serve as a hideous example of what happens to those who flee, the reader begins to glimpse the shape of the tale to come.

There is more, so much more that I can only hint at the richness of Tepper's weaving. I can, however, tell you a little more about the tale's central thrust: When the native God died, it disintegrated in a cloud of spores much like a fungus. Its human attendant promptly died as well and when he was buried, the spores sprouted, sent a vast network of fibrous threads creeping under the settlement, and became a new God, this one for the humans. Now Tepper tells us that the settlement, the only one that had a God before, has always been more peaceful, cooperauve, and productive than the others, apparently because the God facilitates, coordinates, protects. It is a benign God, life-oriented, as unlike the Voorstod God as it is possible to be.

Now the pace quickens relentlessly. The children of the settlement restore a native temple. The new God is found and installed in the temple. The children conspire to give other Hobbs Land settlements Gods of their own. The Voorstoders send their agents to Hobbs Land to steal Maire's grandson, Jep. Maire goes to Voorstod as demanded, with Sam and Jep's young lover, Saturday Wilm. Saturday brings the God's seed with her, with the idea of changing the Voorstod attitudes. They seem to win, but then the Voorstod hardliners gain control of the System's unstoppable robot army and unleash it on Hobbs Land as the first step in the universal devastation of which they dream.

What can a lumpish, rural God hope to do to save its worshippers and charges? I won't say. But rest assured, Tepper does not disappoint. The last third of the book I literally could not put down, and I was very satisfied when I finished it. This one is a definite don't miss.

Ben Bova's *Orion* series addresses the pain and anguish of a man who was made by the Creator Aten (or Apollo, or the Golden One) to serve as a warrior. The Creators are the descendants of the human species. To ensure their own development, they must also ensure the evolution and preservation of humanity. They must thus remove the Neanderthals and defeat their foe, known as Ahriman. Orion's success in these endeavors, and his winning of the love of Anya (Athena), occupied him through *Orion* and *Vengeance of Orion*.

Now Ben gives us **Orion in the Dying Time**. Anya and Orion have ar-

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rived in Pleistocene Egypt, when a reptilian malevolence, later to be known as Set and Satan, is using dinosaurs as hounds to destroy the young human species. Set comes from a world circling a red dwarf that is threatening to go nova and become the planet Jupiter. He wants to make Earth a home for his kind, and if he succeeds, the Creators will never have been. Set *must* be stopped!

But Set is far more powerful than Orion and Anya together. He even seems more powerful than all the Creators together. Orion's and Anya's efforts to free the slaves, teach them agriculture, and bind them together into a force that can hope to slay dinosaurs and resist the reptilian nemesis are therefore obviously doomed from the start. Ben underlines this point again and again as Orion is captured, escapes, leaps seventy million years to the Cretaceous era, and is captured again, tormented, paraded before Set's people, and promised death. Yet Orion is able to develop at need powers which, though struggling and embryonic, are able to defeat the demon. Set helps by consistently underestimating the hero, but I still think Ben made a serious mistake here.[2] His villain is so powerful that it is difficult to believe that a mere human can defeat him. It is also difficult to believe that a human deliberately designed to lack the potentials of the gods can nevertheless find within himself those very powers. It is as if a car, as it flew off a mountain curve, could by an effort of will learn to fly.

The relationship of man and god, the striving of humanity toward divinity, the idea that godhood is within man's reach, this is Ben's theme, and it gives the tale a mythic grandeur that appeals tremendously. But when Ben has Orion seemingly forget his powers—such as the ability to control dinosaurs mentally—until the author has worked his hero into another impossible jam, the logic of the tale suffers seriously. Orion is a hatrack character on which the author hangs whatever hat (power) he wishes at the moment. He does not live and breathe, despite the pain and anguish that afflict him, and the reader's involvement in the tale therefore suffers.

Even so, there is that grandeur, that scope and sweep, the undeniable draw of primal conflict and superpowers and a man who must aid the very gods. The flaws are not enough to spoil the tale.

There is no doubt that Anne McCaffrey has the story-teller's gift. She combines scope, sweep, sentiment, and sense of wonder enough to knock thousands upon thousands of readers off their feet and into their hammocks. She proved her abilities as early as 1969 with *The Ship Who Sang*. Later, her Pernese dragons rewarded her so well that her Irish home is "Dragonhold." And now all those thousands of readers eagerly await her next work.

It's **The Rowan**, and it's as strong as ever in scope, sweep, sentiment, and sense of wonder. In its world, psi powers are common, and the powerful "Primes" occupy the top of any profession that can use a "Talent"—healing, for instance, and the hurling of freight and passenger ships across the interstellar gulfs. Yet Primes are rare, and when a disaster on the Altair colony leaves one survivor, a three-year-old whose screams for help are heard around the planet, the authorities move rapidly to save and nurture the child and eventually train her as a transportation Prime.

[2] He makes minor ones elsewhere. For instance, in the bound galleys I have before me—which will be corrected in many ways before the book hits the stores—he says a sabertooth tiger's sabers were incisors, not canines.

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Named the Rowan child after the town whose destruction she survived, she has snow-white hair (have you ever seen a photo of the author?). Quite naturally, she has personality difficulties, and she is able to find only brief and temporary love.

In due time, the Rowan grows up to be a very lonely, very powerful Prime. She moves to Earth to be the Prime at the Callisto shipping center. The Earth Prime, eager to see if she can have Prime children, sends likely men her way; she turns them all down. But then comes a cry from far Deneb, a colony too young to rate a Prime of its own. Somehow it has bred Talent powerful enough to call Earth and say, "Help! We are under attack by aliens!" The caller is Jeff Raven, and he and the Rowan are an instant match. Enter high romance and long-distance telekinetic goosing.

The rest of the tale settles the alien hash and brings Rowan and Raven together for good. Unfortunately, it does not satisfy. McCaffrey chose to give her heroine the human weakness of a sort of agoraphobia, a dread of space travel. A good deal of the subsequent hithering and dithering therefore concerns how to overcome or override the phobia in order to be with Raven. Even more hithering and dithering concerns the logistical difficulties of making sure the transport Primes are so distributed throughout human space as to handle efficiently all the traffic.

And she makes it all unnecessary. Rowan's almost instant response to the Deneb crisis is to call all humanity's transport Primes (and lesser talents) and say, "Let's merge our minds." And when the result is such a concentration of psychic power that humanity's transport needs and the Primes's travel phobias would both be met if all the transport Talents simply merged routinely—it wouldn't matter where they were or how much tonnage they had to haul—the rest of the tale rather loses its point. Nor does it help that in the context of the story, mind-merging does not seem a remarkable insight.

If you can swallow the psi powers, buy it for the high romance—even for the telekinetic gooses—not for the logic.

Colin Greenland's **Take Back Plenty** first appeared from Unwin Hyman Limited in England. It will be available from Avon next year, and I want to tell you that even though it suffers from some notable anachronisms—Mars with canals, Venus with jungles—and Greenland displays a very liberal hand with the pseudo-technical jabberwocky, it's a fun tale. It's not deep, and it won't live forever, but it's fun.

Take Back Plenty opens with the arrival on Mars of Tabitha Jute, Captain of the *Alice Liddell*,[3] an antique freight hauler. There's a problem with the drive, but Tabitha expects to have the money to fix it as soon as she manages to get through the Carnival crowds to the bar where a potential employer is supposed to be waiting. But on the way, a gang of weaselish aliens, the Perks, attacks her. When she pitches one into the canal, where it demolishes an effigy of a Capellan, the aliens who rule the galaxy and have put a wall around the solar system, she is promptly arrested by Eladeldi cops (doglike aliens) and saddled with a fine which she must pay or lose her ship. She misses her connection with her employer, of course, but then she meets up with an entertainer who hires her to haul his cabaret troupe, Contraband, to Triton, promising to pay

[3] That's right. *The* Alice.

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her enough to settle the fine, fix the *Alice*, and more.

And they are off, first to Plenty, a habitat built by the Frasque, twiggy, insectile, hive-minded aliens, before their schemes of conquest were uncovered and they were conquered and banished. On Plenty, Contraband's manager Hannah waits with the money; she is dead but still, thanks to the wonders of technology, able to talk and deal. Everything seems fine until the cops raid Contraband's performance that evening and Tabitha, *Alice*, and all are off and running, dodging in and out of hyperspace, heading for Triton until they are grabbed by pirates, escaping, crashing on Venus, and being rescued by the pirates and carted off to the Capellan base on Charon. History and background emerge as Tabitha tells *Alice* stories. We learn that *Alice* has unsuspected abilities, not all due to the way hyperspace has of altering ships that pass through it (once, for instance, giving the *Alice* weapons it had never had before, an interesting *deus ex* dodge).

You may frequently be ready to cry "Wait a minute!" at Greenland's twists of plot and bafflegab, which often sound as if they were invented on the spur of the moment, but the tale's momentum will carry you quickly onward. Greenland gives you a wild ride through a strange universe with just enough internal consistency to hold it all together until the end. And at the end, you will surely agree that the ride was worth its price. What more can you ask?

Maps in a Mirror: The Short Fiction of Orson Scott Card is a massive compendium of stories that very nicely illuminates the work of one of today's best science fiction writers. It doesn't contain all of Card's short fiction—the Worthing and Mormon Sea stories have their own books—but just about everything else is here, organized into five "Books" with lengthy introductions on Card's approach to writing and afterwords on the writing of the particular stories. In this material, as well as in the stories themselves, Card stands revealed as an intensely thoughtful, self-conscious, religious, and community-oriented writer. His comments on writing should prove helpful to budding and developing writers, and his remarks about his own life—did you know that he took his Mormon mission in Brazil?—show where some of the material in his stories comes from.

Many of the stories in *Maps* you will have seen before in *Analog*, *Omni*, *Asimov's*, *F&SF*, assorted anthologies, and elsewhere. One, "Memories of My Head," the strange autobiographical account of a man who survives his own suicide, is published here for the first time.

When the paperback edition of *Maps* comes out, it will include only the first four of the book's "Books." The fifth, "Lost Songs: The Hidden Stories," will appear only in the hardbound edition as an incentive for you to pay the higher price. That's a nice gimmick, and I don't really think it's unreasonable; you pay more, you get more. On the other hand, you may not want the "Lost Songs." They include three tales that eventually became novels. These are the original *Analog* versions of *Ender's Game* and *Songmaster* ("Mikal's Songbird") and the long poem ("Prentice Alvin and the No-Good Plow") that turned into the Alvin Maker series. There are in addition several non-science fiction stories, including the charming "Hitching" (from the regional magazine *Mountainwest*), and a few that he wrote under the "Byron Walley" pseudonym for Mormon mag-

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azines. It's all interesting material, worth reading both in its own right and for the light it sheds on Card's career, but if you're not a completist collector or an enthusiastic Card fan, you may prefer to wait and save a few bucks.

Zenith 2: The Best in New British Science Fiction, edited by David S. Garnett, reveals the vast gulf between English and American SF. There are, of course, points of contact: S. M. Baxter's exceedingly quaint tale of wooden Cunard spaceships powered by "anti-ice," "A Journey to the King Planet," has the virtue that if Jules Verne had ever heard of anti-matter, and if *Analog* had been around in Verne's day, he might have written just such a story for this magazine. Another fairly *Analog*ish tale, and one of the best in the book in my opinion, is John Gribbin's "Insight," on exploring a hollow world. Not so *Analog*ish but still among the best are Michael Moorcock's "The Cairene Purse," a mannered exposition of a future Egypt awash in refugees, hippies, and an anthropologist who has fallen in love with abducting saucerites, and Ian MacDonald's "Winning," whose young runner, raised from a Muslim barrio to run for the greater glory of the corporation, discovers honor not quite too late.

But Gribbin, Baxter, Moorcock, and MacDonald account for only a third of the book. The rest seems fairly strong in what remains of the New Wave, with much of the accent on manner and style, ambience and decadence. Certainly there isn't much else to Storm Constantine's "The Time She Became," in which a timeless traveler falls for a while into a world where time is meaningless; or to Jojo Bling's "The Pill," which considers the ultimate drug. Garry Kilworth's Arthurian mockery, "X-calibre," never quite jells. Things improve a bit with Lisa Tuttle's "Dead Television," in which the dead exchange mediums for media; Brian Stableford's "The Furniture of Life's Ambition" (some people are *never* happy); Colin Greenland's "A Passion for Lord Pierrot"; Eric Brown's "The Death of Cassandra Quebec"; and Simon D. Ings' "Different Cities."

David S. Garnett is also the editor of **The Orbit Science Fiction Yearbook 3: The Best Short SF of the Year**. Most of its contents come from the American magazines, and there's a good deal of overlap with the American *Bests*. You'll find three of its dozen stories in the Dozois anthology and two in the DAW (see below). Lucius Shepard's "Surrender," J. R. Dunn's "The Gates of Babel," and Richahrd Paul Russo's "Lunar Triptych: Embracing the Night" made Dozois's list of "Honorable Mentions." The remaining four are John Crowley's "In Blue" from his *Novelty* collection; Robert Silverberg's "The Asenion Solution" from the Asimov festschrift *Foundation's Friends*; David Brin's "Privacy"; and Jayge Carr's "Chimera" (from *Synergy 4*).

What may make the book most worth seeking out for you may be Brian Aldiss's essay, "Why Didn't the Crowd Boo?" on whether novelists tell lies or truth and John Clute's marvelously and acerbically opinionated review of 1989's novels.

Donald A. Wollheim's **1990 Annual World's Best SF** showed up a little later in the year than usual due to the editor's ill health, but it's worth getting anyway because it overlaps relatively little with the Dozois *Best*. Only two of its stories, Gregory Benford's "Alphas" and Brian Stableford's "The Magic Bullet," are

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also in the Dozois. Seven—Brian Aldiss's "North of the Abyss," Robert Silverberg's "Chiprunner" and "A Sleep and a Forgetting," Lisa Tuttle's "In Translation," Judith Moffett's "Not Without Honor," Lucius Shepard's "Surrender," and J. G. Ballard's "War Fever"—are listed among Dozois's "Honorable Mentions." Three—Orson Scott Card's "Dogwalker," James Morrow's "Abe Lincoln in McDonald's," and Barrington J. Bayley's "Death Ship"—make the DAW list alone. I liked the Card, Shepard, Ballard, and Moffett stories best (the last one brings us aliens disguised as Mouseketeers, of all things!). ■

●It is an idle dream to imagine that auto trucks and automobiles will take the place of the long-distance movement of freight and passengers.

Proceedings of the Third
American Road Congress, 1913

●In less than twenty-five years . . . the motor-car will be obsolete, because the aeroplane will run along the ground as well as fly over it.

Sir Philip Gibbs, British journalist, editor, and novelist, *The Day After Tomorrow: What Is Going To Happen to the World*, 1928.

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brass tacks

Dear Dr. Schmidt:

When I was younger I used to read *Astounding/Analog* in a day; now that I'm older, busier, and perhaps slower, at times I don't get through a mag for weeks. Also, I find much less pressing things to read, except for your very excellent and perceptive editorial in the June issue on the Oldtimer Effect.

There is, of course, a definite Old Fogey effect traceable in many things as you mentioned. I've recognized this in myself for some years (I began reading *Astounding* in 1939, so I think I qualify), but I *never* attributed my increasing lack of interest in current SF or cinema to the notion that they made better movies or published better stories in them days. What they did, and I think many folks don't realize or rationalize, is that they made them more to my taste.

The fact is few if any human beings are ever entirely comfortable in a culture that changes significantly from that of their childhood, especially if they were comfortable in that earlier culture. Moi, I don't pretend that the society of the 1930s-1940s was perfect or even equitable; however, it *was* viable vis-a-vis all others on the globe and I was perfectly prepared to cope in it. As a matter of fact, I coped in the culture of the 1960s, 1970s, and 1980s, though to tell the truth I haven't *liked* the tenor of events since 1939. A telling point: the 11th (1940) edition of the *Enc. Brit.* is the last one I choose to read.

I think this syndrome pervades SF, both as a reader and writer. Many of my generation *liked* Heinlein, Poul Anderson, Van Vogt, etc. (Smith was inventive as hell but dull), because their conscious or unconscious world was ours also. We believed that one man not only can make a difference but usually did (try to explain our times without Hitler or Churchill or FDR!) while the

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majority is at best well-meaning and inert, and at worst stupid and intractable. We saw technology not so much as the world's savior but the only way to go—much like so many of us chose to fly airplanes in WW II rather than be drafted and be perverse grunts. We had no use whatever for fantasy or magic; believed reason was a fragile but sharp reed; had at least some feelings that freedom for the wolf was as important as liberty for the lamb in the great scheme of things; and accepted man's tragic destiny as a predator whatever face we put on it.

Golden Age SF was redolent of such cultural values, which went far beyond simple lack of respect for other races and/or cultures. Hell, even Kipling had respect for other cultures; he just didn't fall into the trap of thinking them all equal.

Beyond SF and your grousing older readers, I suspect the same persons are like many I know in other forms of entertainment (and SF is entertainment; it only gets silly when, like some moviemakers, we take ourselves too seriously)—they like older "classic" movies because we think actors should look, behave, and act like Gary Coopers, J. Waynes, Bette Davises, Claudette Colberts, etc. on the screen. Much of the present crop look, talk, and act like trash, and perhaps are. . . .

Liberalism or conservatism doesn't really come into this ideologically speaking, but certainly as people grow more uncomfortable with changing cultures they seem more "conservative" since they don't approve of the change.

If you'll examine the changed culture in SF (which reflects society itself to *some* extent—entertainment culture today is no more "real" than it was fifty years ago, since artists, writers, etc., are never entirely normal or typical people reflecting the mainstream) the Old Fogey perverseness becomes understandable.

Incidentally, your editorial sparked a piece on this subject which I'll publish shortly; thanks for the fertilization!

T. R. FEHRENBACH

San Antonio, TX

Dear Dr. Schmidt,

Taking sick leave to get over the flu, I read the current science fiction and fantasy magazines that had accumulated on my desk. As I struggled in vain to be entertained or informed, I made several decisions about good writing.

1. Good stories do not drip with angst over causes too nebulous for even the Hubble telescope to resolve.

2. Science fiction should be *relevant* to our times, yet the essence of science fiction is a creative and provocative "what-if."

3. Overly derivative fantasy fails. Laws of entropy dictate that replication exaggerates flaws and reflects less and less of the Light—even such a Light as Tolkien's.

4. Propagandizing for women's rights, or whatever, is OK *if* it still makes a good story.

5. Good short stories are written to be short stories. "Best parts" from flaccid novels don't make it.

Your "The Oldtimer Effect" editorial gave me a profoundly conscious twinge. Then I read the rest of magazine and wondered if I had twinged for naught. Which of us are oldtimers: you who publish what I enjoy reading—or me?

I found the "Kittens" in "The Flowers, The Birds, The Leaves, The Bees," by L. A. Taylor as fascinating as those bizarre barrel creatures rolling around Mars in "Martian Odyssey" written long before we put probes on Mars.

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• "Funnel Hawk," "The New Land," and "Wanderers" promoted that sense of wonder I discovered as an eleven-year-old reading Heinlein, Sturgeon, Pangborn, and Clarke.

These stories have science that is convincing and interesting—real dangers, creative premise and resolution, and characters that harbor life-positive ethic.

The stories also have humor. "To Victor Go the Spoils" by Grey Rollins, compares delightfully to any alien detective story even if we take *Caves of Steel* as a comparison.

Could you define which worthy works are disdained by those who have no taste for new things? I am puzzled. And definitely don't stop doing what you do as far as choosing stories for publication.

C. L. HAWTHORNE
7207 NE 92nd Avenue
Vancouver, Washington 98662

Dear Stan,

Having been accused of incipient fossilization myself, I read your "oldtimer effect" editorial with great interest. I'd like to offer some further thoughts on the topic.

1. About the glister lent to the past by selective memory: yes, it's possible that some stories hold up on re-reading only because they are familiar, but some hold up because they are *good* stories. In the old days, alas, these were rarer than we fossils like to think: on going back to read some of the tales that shine in memory I find that in most cases what I remember is chiefly an aura, an idea. The style turns out to be just plain awful. The pacing of the story is artificial. Logic, both of narrative and of science, gets battered. The urge to pick up a pencil and improve the story becomes almost irresistible. Most non-writers, though, aren't as sensitive to these factors as those of us who fight them every day: for many readers, the luster remains.

The stories that hold up best for me are *well-written* and *take as their central problem* one that has been my own in another guise. People tend to maintain the same set of problems throughout their lifetimes. What "old-timers" are asking for is more exploration of what *still concerns* them. In fact, the old veins are not mined out. Good stories of those types could still be written. They would have an audience. (SF has many audiences, many of which can't stand anything the others like, no matter what the age of their members.)

2. The more things *I* experience, the newer many seem. Try talking to a child, as I do with my fourteen-year-old daughter. My grade-school life was without television, let alone commercial jet aircraft, computers (I graduated from college just before the transistor became a practicable gadget), felt-tip pens, microwave ovens, tape cassettes, or many other things I use every day. My mother's childhood, spent not more than twenty miles from your editorial offices, included horses and wagons, woodstoves and kerosene lamps, not because of some back-to-the-basics philosophy but because that's what there was. I can wear on my wrist circuitry that would have occupied as much space as my desk does at the time Armstrong set foot on the Moon. Some people do find these enormous changes frightening. Others plunge in. Most live in between, or ignore them. (I remember buying a computer a few years ago and overhearing one salesman saying to another as I walked out, "She'll have that back in a week. She's too old to learn anything." True, I can easily write with paper and pen, but that doesn't mean I'd give up word processing without a fight. On the other hand, if you asked

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me what the greatest modern technological convenience in my house is, I'd have to say potable running water.)

3. Those of us who discovered SF more than, say, 35 years ago often experienced that first story almost as religious revelation. We'd been going along reading whatever it is that other eight or twelve or twenty-year-olds were reading, saying in effect, "hmm, that's nice," or "hum, why am I reading this?" and then *POW*, Gernsbach or Van Vogt or Padgett or del Rey or de Camp or Boucher or (in my case) Asimov hit us with a story that, to use a later idiom, blew our minds. Of *course* we can't recapture the effect of those first stories, but that doesn't stop us from wanting to, even though with greater maturity and experience those stories show themselves as, mmm, less mind-blowing than we can quite account for. Oddly enough, I haven't heard this kind of tale from younger readers. It's as if, having grown up under the shadows of satellites, they've missed that initial wow, the sense of perhaps-soon-to-be-fulfilled incredible possibility that older readers had at their age.

4. In science fiction, as in every other form of art, there are fads. The diversity of types can become bewildering. It's hard to get much sense of what you're about to read when you pick up a book by an unfamiliar author. Cover art and blurb aren't much help. Word of mouth is more reliable. But many SF readers, especially older ones, tend to be somewhat solitary in their reading habits and don't have word-of-mouth as a guide. To go into a store able to afford to buy at most three books and be confronted by several thousand titles is daunting. The old way of exploring, through public libraries, is less useful than it used to be because libraries don't seem to buy much SF. Probably it's my biased imagination, but it seems to me that's the first category cut when the budget collapses. (Certainly my branch library has more cookbooks than it does science fiction.) A person looking for something on the order of Ray Bradbury's more delicate stories who picks up William Gibson is likely to be disappointed in his purchase. Over-generalization being a built-in defect of the human mind—witness the foregoing phrase—suddenly all SF is going to the dogs.

It isn't, of course. It's just changing and diversifying, just as society is changing and diversifying often at a stupefying speed. But in a world that went from the friction match to controlled nuclear fission in just over a century, from a contraption built by a couple of bicycle mechanics to supersonic flight in under half a century, from a basketball-sized satellite to men walking on the Moon in just over a decade—and that over twenty years ago—we are going to have to learn to change while hanging onto enough of our past to keep our balance, our sense of ourselves. This is what the old timers are saying, whether they know it or not. It's a valid point.

L. A. TAYLOR

Dear Dr. Schmidt—

As a faithful reader of the magazine for the last 46 years I want to make a comment about your "Oldtimer Effect" editorial. At 66, I found it surprisingly insightful coming from a young fellow like you, and think all three points are well taken. But there's also a fourth factor, which I've felt strongly in my work as an aging columnist. Since we are aware of the changed context of life each decade, and react to it no less—although differently—than younger people, we feel a certain degree of disconnection from our *own* memories and our own habitual, taken-for-granted re-

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sponses. Subjected to current methods of perception, we acquire some distortion of our own past even as we cling to it. The Beethoven symphony I hear now is not only played differently than it was in the 1930s, but my ears have absorbed all kinds of sounds (and normalized them) they hadn't yet heard in the 1940s.

So yes, I remember selectively the good; and experience makes it harder to be struck by something as fresh and unprecedented; and yes, there's less craving for novelty, which implies a degree of discomfort in dealing with the unfamiliar. But all three influences are heightened by my own altered (often subliminally) responses even to the familiar. The effort needed to retain or recapture old pleasures, even when available, in the new context of the present, makes adjusting to the actually new even less welcome. And romanticizing the past, while resisting the present, becomes a way of hanging on to a capacity for enjoyment that seems to be diminishing.

There's a fifth point which may be a personal quirk of mine, but may be shared by many others. Not only is old material familiar ground and therefore easier to deal with, but as time goes on (and grows short), I realize how much of the familiar-type material I haven't yet learned or drained, and the urge to forage there gets stronger than the desire to explore newer fields. With so much still relatively untouched (by me) Beethoven out there, I have less and less urge to confront John Cage.

Good editorial. Good magazine. Yours is a good regime in a noble tradition. Nice going.

LEONARD KOPPETT

Palo Alto, CA

Dear Dr. Schmidt:

If the Oldtimer (June 1990 editorial) is unable to objectively evaluate the new stuff, and the Newtimer (my phrase) does not empathize with the old stuff, then *who* is to compare them for purposes of deciding whether the trend is upward or downward?

And *how* will that hypothetical person do it? The Oldtimer persists in evaluating the new stuff by the old standards, and the Newtimer (the ones I know) denies that there are any standards at all. The very idea of something permanent and ongoing by which other things are measured is deemed undemocratic and elitist.

You're very right about old timerism. I'm going on 63, and don't think there's been any good music since Benny Goodman. Nor is "modern" poetry really poetry. Nor is "modern" art really art. Of course I tend to think my reactions are due to objective, accurate determinations based on permanent standards. And of course people in their twenties feel I am merely being nostalgic.

Do publish a story which solves this dilemma. Of course, the basic requirement is that it must finish up acknowledging my position is correct.

RINEHART S. POTTS

Glassboro, NJ

Why does anyone *need to make an evaluation which everybody should consider Correct? Such language is simply not appropriate to all contexts. The length of a meter is something that can be settled unequivocally and unanimously; the value of an art work is not, because its value depends on how it affects an observer, and it doesn't affect any two observers the same way. This concept seems enormously difficult for many people to grasp, yet it is so central to human affairs that I've dealt with it before (e.g., "Matters of Opinion," Mid-December 1987) and will no doubt return to it again.* ■

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a calendar of analog upcoming events

28 February-3 March
World Horror Convention at Hyatt Regency, Nashville, Tenn. Guest of Honor—Chelsea Quinn Yarbro, Artist Guest of Honor—Jill Bauman, TMs—Richard Christian Matheson, David Schow, John Skipp, Craig Spector. Registration—$60, limited to 1000 members. Info: World Horror Convention, Box 22817, Nashville TN 37202. (615)385-0917.

8-10 March
LUNACON 1991 (New York City regional SF conference) at Sheraton Stamford Hotel, Stamford, Conn. Guest of Honor—David Brin, Artist Guest of Honor—Frank Kelly Freas, Publisher Guests of Honor—Ian & Betty Ballantine, Fan Guest of Honor—Harry C. Stubbs (Hal Clement). Registration—$20 in advance, $30 at the door. Info: Lunacon 1991, Box 338, New York NY 10150-0338.

21-24 March
AGGIECON XXII (Texas A&M SF conference) at Memorial Student Center, Texas A&M University. Guests: Marv Wolfman, Richard Pini, Kerry O'Quinn, Ardath Mayhar. The usual plus Quest, Lazer Tag, SF Game Shows. Registration—$13 until 1 March, $16 thereafter; $10/day. Info: AggieCon XXII, MSC Cepheid Variable, Box J-1, College Station TX 77844. (409)845-1515.

22-24 March
MILLENICON-10 (Dayton area SF conference) at Stouffer's Center Plaza, Dayton, Ohio. Guest of Honor—C. J. Cherryh, Science Guest of Honor—Bill Breuer, Fan Guest of Honor—Joe Patrouch. Registration—$25 in advance and at the door. Info: MilliCon-10, % Terri Ruwe, Box 636, Dayton OH 45405. (513)294-7211.

28-31 March
NORWESCON 14 (Seattle area SF conference) at Sheraton Hotel, Tacoma, Wash. Guest of Honor—Stanley Schmidt. Fan Guest of Honor—Becky Thomson. Registration—$30 until 1 March, $35 at the door. Info: Norwescon 14, NWSFS, Box 24207, Seattle WA 98124. (206) 248-2010.

29 March-1 April
SPECULATION (42nd British National SF Convention) at Hospitality Inn, Glasgow, Scotland. Guest of Honour—Robert Holdstock. Registration—£20 attending, £10 supporting. Info: Speculation, 35 Buller Road, London N17 9BH, England, UK.

29 August-2 September
CHICON V (49th World Science Fiction Convention) at Hyatt Regency, Chicago, Ill. Guest of Honor—Hal Clement; Artist Guest of Honor—Richard Powers; Editor Guest of Honor—Martin H. Greenberg; Fan Guests of Honor—Jon & Joni Stopa. Registration—$95 until 31 December 1990. Supporting—$20 at all times. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Chicon V, Box 218121, Upper Arlington OH 43221-8121.

8-14 September
VOLGA-CON (International SF convention on the Volga). Sponsored by SF Club "The Winds of Time" and the Youth Association ATOM. Info: Volga-con, % Boris A. Zavgorodny, Volgograd-66, Poste restante, 400066 USSR. Telephones: 34-74-62, 34-74-64, 34-44-09, 34-86-56.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

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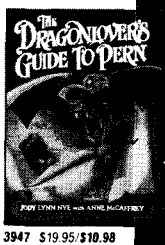

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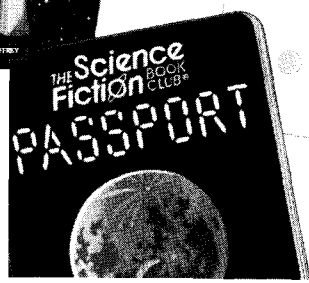

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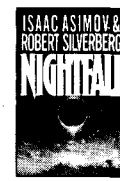

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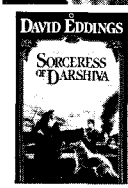

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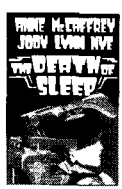

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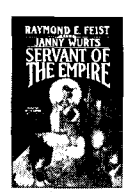

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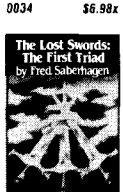

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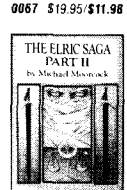

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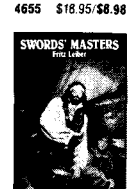

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